COMPUTER PROGRAMS

FOR

NATIONAL DATA BUOY SYSTEMS

SIMULATION AND COST MODELS

by

Earl L. Davis
Project Scientist

and

Bernard J. Erickson
Edward R. Sweeton

October 1968

TRC Report 7493-333
Prepared for the U.S. Coast Guard
Under Contract No. DOT-CG-82504-A

E. J. Aubert
G. M. Northrop
Principal Investigators

THE TRAVELERS RESEARCH CENTER, INC.
250 CONSTITUTION PLAZA, HARTFORD, CONN. 06103

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This study was conducted in support of the U.S. Coast Guard National Data Buoy Systems Designated Project Office under Contract DOT-CG-82504-A.

Views or conclusions contained in this study report should not be interpreted as official opinion or policy of the Federal Government.

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FOREWORD

Contract Number DOT-DG-82504-A between the U.S. Coast Guard and The Travelers Research Center, Inc. (TRC) consists of five parallel activities. The five final reports stemming from these activities are entitled:

(1) Applicability of National Data Buoy Systems to Refined National Requirements for Marine Meteorological and Oceanographic Data.

(2) Characteristics of National Data Buoy Systems: Their Impact on Data Use and Measurement of Natural Phenomena.

(3) Cost Effectiveness Sensitivity of National Data Buoy Systems: An Essay.

(4) Computer Programs for National Data Buoy Systems Simulation and Cost Models.

(5) An Analysis of Cruise Strategies and Costs for Deployment of National Data Buoy Systems.

Each of these five reports is complete in itself, but it must be recognized that in all instances the other four activities both influenced and contributed to the results presented in each individual report.

The present USCG/TRC contract is an outgrowth of a study of the feasibility of national data buoy systems performed by TRC and Alpine Geophysical Associates for the USCG during 1967. Need was evident for investigation, research, and analysis in greater depth in several areas to support the concept formulation and deployment planning efforts of the newly-formed U.S. Coast Guard National Data Buoy System Designated Project Office (NDBS DPO). This report and the other four cited above satisfy some of those needs.

All five TRC reports have benefited from the close cooperation and guidance afforded by the USCG NDBS DPO staff: Capt. J. Hodgeman (Project Manager), Cmdr. V. Rinehart, J. Wesler, E. Parker, P. Morrill, and Lt. Cmdr. W. Merlin (Contract Monitor).

PREFACE

This document is divided into three sections to logically present a different level for three sets of readers. Section 1, General Descriptions of Buoy Computer Programs and Data, provides a comprehensive summary of the computer programs and data developed by The Travelers Research Center, Inc. (TRC). This section is primarily for a management overview and is intended to present computer program capabilities and data descriptions with a minimum of the related details. Included in Section 1 is a description of the:

(1) Integrated Buoy Deployment Cost Model Program

(2) Procurement, Maintenance, and Replacements-Cost Model Program

(3) 10-year TDP Financial Plan Program

(4) Buoy Component Characteristics Data File

(5) Fleet Numerical Weather Central Depth Data.

Section 2, Computer Programs Operating Instructions, is for those persons desiring another level of detail about the programs. This section presents the information necessary to prepare data card decks and operate the computer programs. It is assumed that the reader of this section is familiar with basic automatic data processing.

Section 3 is the Maintenance Programmer's Manual for the programs and data described. This section is for an experienced FORTRAN programmer and is supplemented with appropriate flow diagrams, compilation listings and tape dumps in Appendixes A through N.

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1.0 GENERAL DESCRIPTIONS OF NATIONAL DATA BUOY SYSTEMS AUTOMATED MODELS AND DATA

Part of the 1968 TRC contractual effort for the U.S. Coast Guard National Data Buoy Systems Designated Project Office (NDBS DPO) was directed toward automating a selected set of manual simulation and cost models. These models were developed in the 1967 TRC Study of the Feasibility of National Data Buoy Systems and are used to determine the deployment, maintenance and replacement cost characteristics for alternative data buoy system configurations. A corollary objective, under the task of buoy model automation, was to prepare the 1967 buoy components data base for further automated processing. A computer model was also developed to assist in the analysis of the funding schedules considered in the development of a Technical Development Plan.

This report describes all the features of the computer models and programs and presents the information necessary to operate and maintain the programs. A detailed study based on the data buoy system deployment cost model is found in a companion report.[1]

1.1 Integrated Buoy Deployment Cost Model

1.1.1 Introduction

Early in the 1967 TRC study of the feasibility of NDBS, cost models were developed to estimate the cost of buoy deployments, maintenance, replacements and spares. These were manual models and their scope and detail were quite limited. As some of these problems associated with a NDBS were to be studied in greater depth, it was apparent that an automated buoy deployment cost model would be essential to provide the data necessary for trade-off studies of some of the variables involved in buoy deployment and maintenance. Therefore, TRC developed an integrated buoy deployment simulation and cost model computer program that computes the times, distance, and costs associated with the deployment of specified buoy systems and deployment strategies.

1.1.2 Program Function

The basic purpose of the buoy deployment cost model is to compute the time and costs required to deploy a specified buoy system. The input information must include

[1] Northrop, G. M., 1968: An Analysis of Costs and Cruise Strategies for Deployment of National Data Buoy Systems, Report 7493-337, The Travelers Research Center, Inc., Hartford, October.

data for all of the items listed in Table 1-1. To do this, the user defines the ship cruises necessary to deploy all the buoys. The program computes the great circle distance between the prescribed points and converts this distance to the sailing time required for each of eight ship speeds. To each of these sailing times are added the total time required to implant the buoys for each of four buoy implanting times. This sum is the total ship sea days required for each ship and buoy implanting time. The number of port days for each cruise is computed as a function of the ship buoy-carrying capacity and the number of buoys on-loaded. The algorithm used is:

$$\text{Port Days} = \text{Min. Port Days} + \left[\frac{(\text{Buoys On-Loaded})}{(\text{Max. Buoy Capacity})} \times (\text{Max. Port Days} - \text{Min. Port Days})\right] \quad (1\text{-}1)$$

The sum of all ship sea days and port days is the minimum possible ship days for that deployment.

Costs for the number of ship sea days, port days and distance traveled as a function of ship speed is computed using three different basic ship sea-day costs. The minimum time and cost values are also multiplied by a safety factor (typically 4/3) to provide a "reasonable" upper limit to be used with the minimum time and cost values. The average deployment cost per buoy, the number of buoys that can be deployed in a ship work year and the total buoy hardware cost as a function of water depth are also computed.

1.1.3 Program Output

The output of the deployment model is a printed listing of the results of the run. The various types of output pages, in the order in which they are produced, are as follows:

Constants Page. All input variables used during a computer run are listed with the output. The majority of these variables are presented on a Constants Page as illustrated in Fig. 1-1. Notice in Fig. 1-1 that there are specified desired and maximum sea days per cruise. The program is designed to output a message if a cruise will require a greater number of sea days than the specified desired value, although it will continue to deploy buoys. However, the program will terminate if a cruise will require more time than the specified maximum sea days per cruise.

TABLE 1-1
USER-SPECIFIED INPUT VARIABLES FOR THE DEPLOYMENT MODEL

A. Buoy Data

1. Latitude, longitude and water depth for each buoy.
2. Buoy hardware cost: basic buoy, mooring line, oceanographic sensor package.
3. Mooring scope.

B. Ship Port and Buoy Depot

1. Latitude and longitude for both port and depot.
2. Minimum and maximum allowed days in port.

C. Ship Characteristics

1. Ship buoy-carrying capacity.
2. Ship speeds (8 speeds per run).
3. Basic costs per ship sea day (3 values).
4. Ship "maintenance" cost per sea day as a function of speed and size.
5. Cost per nautical mile travelled.
6. Hours required to implant a buoy (4 values).
7. Maximum allowed sea days for a cruise.
8. Days per year the ship is not available (overhaul).

D. Additional Data

1. Navigation points to route around islands and peninsulas.
2. A safety factor used to multiply all computations in order to obtain a "reasonable" upper boundary on costs, cruise times, etc

```
RUN NBK 110    DATE  4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

STARTING DEPLOYMENT DATE =  1 JAN 69

CONSTANTS USED FOR THIS DEPLOYMENT

  PORT
    NAME = HONOLULU, HA
    LAT  = 21.3N
    LONG =157.8W

  DEPOT
    NAME = HONOLULU, HA
    LAT  = 21.3N
    LONG =157.8W

  SHIP
    NAME =
    AVERAGE CRUISING SPEED, KTS =  9.0
    MAXIMUM BUOY CAPACITY       = 12
    OVERALL SAFETY FACTOR       =  1.33
    HOURS TO IMPLANT 1 BUOY     = 12.0
    DESIRED SEA DAYS PER CRUISE = 30.0
    MAXIMUM SEA DAYS PER CRUISE = 99.0
    MAXIMUM PRT DAYS PER CRUISE = 10.0
    MINIMUM PRT DAYS PER CRUISE =  4.0

    LOAD/CRUISE
     10  8 12 12

    NAV POINTS/CRUISE
      0  2  0  0


  BUOY COSTS
    BUOY W/O S/S SENSORS OR MOORING = $ 158000.
    SUBSURFACE SENSOR PACKAGE, EACH = $   7000.
    MOORING LINE PER 1000 FT        = $   1750.
    MOORING SCOPE =  1.00
```

Fig. 1-1. Data Buoy Deployment Constants Page.

The entries in Fig. 1-1 under LOAD/CRUISE are the number of buoys to be carried on each cruise. The entries under NAV POINTS/CRUISE are the number of navigation points required for each cruise.

Buoy Hardware Cost and Order Page. Figure 1-2 is a listing of a set of buoys in the order in which they were deployed. Buoy location, water depth, the number of subsurface sensor packages required for each buoy and total hardware cost is also shown. It is possible to specify different basic buoy costs for individual buoys, although the costs are all the same in Fig. 1-2. Buoy numbers are an arbitrary assignment of four alphanumeric characters. Normally, they are chosen to facilitate their location on a plotted buoy map. Water depths may be input either in feet or meters; all depths are converted to feet for output on this page.

Cruise Deployment Summary Page. This page contains the highlights of the calculations performed after each cruise is completed; it is illustrated in Fig. 1-3. The distance between successive points is presented in the fourth column and is the distance between buoys, in the order in which they are deployed. The calendar dates presented are based on the starting deployment date, a 30-day month, and the elapsed deployment days until each event is completed. Cost values on this page are computed only for the slowest ship speed, the shortest implanting time and the middle ship sea-day cost value.

The printing of the cruise deployment summary page is optional and is usually by-passed if there is a large number of cruises to be made.

System Deployment Summary Page. Significant cruise and system totals are presented on the system deployment summary page as shown in Fig. 1-4. The entries on this page are self-explanatory.

Deployment Test Summary Page. The test summary pages are a presentation of all of the critical time and cost values for the deployment just completed. An example of this type of output page is shown in Fig. 1-5. The critical constants used and the critical values calculated are listed in the first ten lines of output. Of particular importance among these constants are

(a) The ship buoy-carrying capacity,

(b) The base cost per sea day,

(c) The ratio of the cost per port day to cost per sea day,

RUN NBR 110   DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

BUOYS - IN ORDER DEPLOYED

NBR	DEGS LAT	DEGS LONG	DEPTH (FT)	BASIC COST	S/S PKGS	TOTAL COST
EP10	30.0N	161.2W	18045	$158000.	20	$329579.00
EP 5	40.0N	165.0W	18045	$158000.	20	$329579.00
EP 2	50.0N	180.0W	21000	$158000.	20	$334750.00
EP 1	60.0N	180.0W	6561	$158000.	17	$288482.00
WP 3	50.0N	166.0E	18045	$158000.	20	$329579.00
WP 6	41.5N	167.0E	19685	$158000.	20	$332449.00
EP 4	40.0N	180.0W	18045	$158000.	20	$329579.00
EP 8	32.4N	177.5E	16404	$158000.	20	$326707.00
EP 9	30.0N	169.6W	16800	$158000.	20	$327400.00
EP33	24.0N	164.0W	14764	$158000.	20	$323837.00
WP 8	36.7N	158.8E	12000	$158000.	19	$312000.00
WP 5	40.0N	153.5E	14700	$158000.	20	$323725.00
WP 4	40.0N	139.0E	3280	$158000.	15	$268740.00
WP 7	33.0N	143.2E	22966	$158000.	20	$338191.00
WP11	30.0N	155.5E	19029	$158000.	20	$331301.00
WP28	25.0N	165.0E	19685	$158000.	20	$332449.00
WP17	23.0N	171.0E	19200	$158000.	20	$331600.00
EP14	20.0N	168.5W	16404	$158000.	20	$326707.00
EP13	20.0N	180.0W	14764	$158000.	20	$323837.00
WP18	20.0N	158.8E	19685	$158000.	20	$332449.00
WP16	23.0N	146.0E	19685	$158000.	20	$332449.00
WP10	27.0N	135.0E	14764	$158000.	20	$323837.00
WP 9	[illegible].0N	126.4E	656	$158000.	9	$222148.00
WP13	20.0N	116.0E	3280	$158000.	15	$268740.00
WP14	20.0N	126.7F	16404	$158000.	20	$326707.00
WP15	20.0N	137.0E	16404	$158000.	20	$326707.00
WP24	14.0N	153.0E	19685	$158000.	20	$332449.00
WP26	15.0N	170.0F	16200	$158000.	20	$326350.00
EP12	10.0N	179.0E	14764	$158000.	20	$323837.00
FP19	10.0N	170.8W	16404	$158000.	20	$326707.00
WP25	10.0N	158.3F	18045	$158000.	20	$329579.00
WP29	11.0N	145.0E	15000	$158000.	20	$324250.00
WP23	10.0N	137.7E	16404	$158000.	20	$326707.00
WP22	10.0N	127.0E	22966	$158000.	20	$338191.00
WP21	10.0N	116.5E	492	$158000.	8	$214861.00
WP19	0.1N	123.2E	1312	$158000.	11	$2372[illegible]6.00
WP20	0.1N	134.0E	14108	$158000.	19	$315689.00
WP12	0.1N	144.2E	131[illegible]3	$158000.	19	$313965.00
WP 2	0.1N	154.8E	8202	$158000.	18	$298354.00
WP 1	0.1N	165.5E	16404	$158000.	20	$326707.00
WP27	0.1N	176.0E	13800	$158000.	19	$315150.00
EP28	0.1N	173.7W	16404	$158000.	20	$326707.00

TOTAL BUOY HARDWARE COST (W/O SPARES) $ 13250314.00

TOTAL NBR OF BUOYS TO BE DEPLOYED = 42

Fig. 1-2. Data Buoy Hardware Cost and Deployment Order Page.

RUN NBR 110 DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

CRUISE DEPLOYMENT SUMMARY

CRUISE 1

ON-LOADED 10 BUOYS AT HONOLULU, HA
SHIP UNDERWAY 1 JAN 69 AT 800 HRS, SEADAYS = 0.0

BUOYS IMPLANTED IN FOLLOWING ORDER

BUOY NBR	DEGS LAT	DEGS LONG	N MI BTWN	N MI TO PORT	DATE	SEA DAY	DPLYMT DAY
EP10	30.0N	161.2W	554	554	4 JAN	3.1	3.1
EP 5	40.0N	165.0W	629	1183	7 JAN	6.5	6.5
EP 2	50.0N	180.0W	873	2020	12 JAN	11.0	11.0
EP 1	60.0N	180.0W	601	2510	15 JAN	14.3	14.3
WP 3	50.0N	166.0E	767	2428	19 JAN	18.4	18.4
WP 6	41.5N	167.0E	512	2152	22 JAN	21.2	21.2

EXCEEDED DESIRED SEA DAYS TO IMPLANT ABOVE BUOY

EP 4	40.0N	180.0W	598	1597	25 JAN	24.5	24.5
EP 8	32.4N	177.5E	472	1478	28 JAN	27.2	27.2
EP 9	30.0N	169.6W	678	825	2 FEB	30.8	30.8
EP33	24.0N	164.0W	468	380	4 FEB	33.5	33.5

SHIP RETURNED TO HONOLULU, HA ON 6 FEB 69 AT 1400 HRS

N MILES STEAMED THIS CRUISE = 6536

BUOYS IMPLANTED THIS CRUISE = 10

TOTAL BUOY IMPLANTED TO DATE = 10
BUOYS REMAINING TO BE DPLYD = 32

MINIMUM PSBL SEA DAYS FOR THIS CRUISE = 35.3
MINIMUM REQUIRED PORT DAYS = 9.0

MINIMUM PSBL DEPLOYMENT DAYS TO DATE = 44.3

MIN DPLYMT DAYS X SAFETY FACTOR = 58.9

------------ AT $ 5600.00 PER SEA DAY -------------
MINIMUM SHIP COST FOR THIS CRUISE $ 282627.00
MIN SHIP COST X SAFETY FACTOR $ 375893.00

TOTAL MINIMUM SHIP COST TO DATE $ 282627.00

TOTAL MIN COST X SAFETY FACTOR $ 375893.00

Fig. 1-3. The Cruise Deployment Summary Page.

RUN NBR 110 DATE 4 OCT 68

WEST PACIFIC MDZ FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

SYSTEM DEPLOYMENT SUMMARY

STARTING DATE = 1 JAN 69 AT 800 HRS

CRUISE NBR	BUOYS DPLYD	N MILES STEAMED	MIN SHIP SEA DAYS	MIN SHIP PRT DAYS	TOTAL MIN DPLY DAYS	MIN X SAFETY
1	10	6536	35.3	9.0	44.3	58.9
2	8	7520	38.8	8.0	46.8	62.3
3	12	10531	54.8	10.0	64.8	86.1
4	12	11189	57.8	10.0	67.8	90.2
4	42	35778	186.6	37.0	223.6	297.4

------------- AT $ 5600.00 PER SEA DAY --------------
MINIMUM SHIP COST FOR THIS DEPLOYMENT $ 1446756.00
MINIMUM SHIP COST X SAFETY FACTOR $ 1924185.00

TOTAL COST FOR BUOY HARDWARE DEPLOYED $ 13250314.00

TOTAL FEET OF MOORING REQUIRED = 623613
TOTAL S/S SENSOR PACKAGES DPLYD = 789

AVERAGE DEPTH PER BUOY IN MDZ = 14847
AVERAGE NBR OF S/S PKGS PER BUOY IN MDZ = 18

AVERAGE HARDWARE COST PER BUOY IN MDZ $ 315484.00

AVERAGE DISTANCE TRAVELED PER BUOY DEPLOYED = 851 N MI

SUMMARY OF CONSTANTS USED FOR THIS DEPLOYMENT
SHIP AVERAGE SPEED = 9.0
SHIP MAX BUOY CAPACITY = 12
HRS TO IMPLANT 1 BUOY = 12.0

MAXIMUM GEOGRAPHICAL LOCATIONS

WEST	NORTH	EAST	SOUTH
50.0N 180.0W	60.0N 180.0W	10.0N 179.0E	0.1N 123.2E

THE SHORTEST MOORING WAS 492 FEET AT 10.0N 116.5E
THE DEEPEST MOORING WAS 22966 FEET AT 33.0N 143.2E

Fig. 1-4. System Deployment Summary Page.

RUN NBR 110 DATE 4 OCT 68

DEPLOYMENT TEST SUMMARY

WEST PACIFIC MO7 FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS

42 BUOYS DEPLOYED FROM HONOLULU, HA SHIP BUOY CAPACITY = 12
TOTAL DISTANCE, N MI = 35778 MAXIMUM CRUISE, N MI = 11189
BASE COST PER SEA DAY = $ 2000.00 COST/PORT DAY =0.94 X SEA DAY

SPEED KN	9.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00
CST/MI $	5.78	5.78	5.78	7.01	11.27	16.43	23.37	30.00
ADD/DY $	600.00	600.00	600.00	600.00	780.00	980.00	1200.00	1400.00

AVG SHIP SPD	MAX CRSE (DAYS)	MIN SEA DAYS	MIN PORT DAYS	MIN DPLY DAYS	MIN X SAF FCTR	DEPLOYMENT COST, $K MIN DPLY DAYS	X SAF FACTOR	AVG/BUOY (MIN)	AVG MIN DPLY DAYS PER BUOY	AVG NBR BUOYS DPLY PER SHIP IN 335 DAYS
12 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 21.0 DAYS -----										
9.0	57.8	186.6	37.0	223.6	297.4	782.5	1040.7	18.6	5.3	63
12.0	44.9	145.2	37.0	182.2	242.4	674.8	897.5	16.1	4.3	77
15.0	37.1	120.4	37.0	157.4	209.3	610.2	811.6	14.5	3.7	89
18.0	31.9	103.8	37.0	140.8	187.3	611.2	812.9	14.6	3.4	100
21.0	29.2	92.0	37.0	129.0	171.6	755.6	1005.0	18.0	3.1	109
24.0	25.4	83.1	37.0	120.1	159.8	939.2	1249.1	22.4	2.9	117
27.0	23.3	76.2	37.0	113.2	150.6	1191.3	1584.5	28.4	2.7	124
30.0	21.5	70.7	37.0	107.7	143.2	1432.0	1904.5	34.1	2.6	131
24 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 42.0 DAYS -----										
9.0	63.8	207.6	37.0	244.6	325.4	837.1	1113.3	19.9	5.8	58
12.0	50.9	166.2	37.0	203.2	270.3	729.4	970.1	17.4	4.8	69
15.0	43.1	141.4	37.0	178.4	237.3	664.8	884.2	15.9	4.2	79
18.0	37.9	124.8	37.0	161.8	215.2	665.8	885.5	15.9	3.9	87
21.0	34.2	113.0	37.0	150.0	199.5	814.0	1082.6	19.4	3.6	94
24.0	31.4	104.1	37.0	141.1	187.7	1001.7	1332.3	23.9	3.4	100
27.0	29.3	97.2	37.0	134.2	178.5	1258.5	1673.8	30.0	3.2	105
30.0	27.5	91.7	37.0	128.7	171.2	1503.4	1999.5	35.8	3.1	109
30 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 52.5 DAYS -----										
9.0	66.8	218.1	37.0	255.1	339.3	864.4	1149.6	20.6	6.1	55
12.0	53.9	176.7	37.0	213.7	284.3	756.7	1006.4	18.0	5.1	66
15.0	46.1	151.9	37.0	188.9	251.2	692.1	920.5	16.5	4.5	74
18.0	40.9	135.3	37.0	172.3	229.2	693.1	921.8	16.5	4.1	82
21.0	37.2	123.5	37.0	160.5	213.5	843.2	1121.5	20.1	3.8	88
24.0	34.4	114.6	37.0	151.6	201.6	1033.0	1373.9	24.6	3.6	93
27.0	32.3	107.7	37.0	144.7	192.5	1292.1	1718.5	30.8	3.4	97
30.0	30.5	102.2	37.0	139.2	185.1	1539.1	2046.9	36.6	3.3	101
36 HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT = 63.0 DAYS -----										
9.0	69.8	228.6	37.0	265.6	353.3	891.7	1186.0	21.2	6.3	53
12.0	56.9	187.2	37.0	224.2	298.2	784.0	1042.8	18.7	5.3	63
15.0	49.1	162.4	37.0	199.4	265.2	719.4	956.8	17.1	4.7	71
18.0	43.9	145.8	37.0	182.8	243.2	720.4	958.1	17.2	4.4	77
21.0	40.2	134.0	37.0	171.0	227.4	872.4	1160.3	20.8	4.1	82
24.0	37.4	125.1	37.0	162.1	215.6	1064.3	1415.6	25.3	3.9	87
27.0	35.3	118.2	37.0	155.2	206.4	1325.7	1763.2	31.6	3.7	91
30.0	33.5	112.7	37.0	149.7	199.1	1574.8	2094.4	37.5	3.6	94

Fig. 1-5. Buoy Deployment Test Summary Page.

(d) The ship speed table versus the additional cost-per-mile for each ship, and

(e) The ship speed table versus the additional (maintenance) cost that is added to the cost for each ship sea day.

The remaining tabular data in Fig. 1-5 presents the resulting calculations for each ship as a function of its speed and time to implant a buoy.

Minimum sea days and minimum port days (Cols. 3,4) in Fig. 1-5 are added together to give minimum deployment days (Col. 5) which is then multiplied by the safety factor to produce minimum deployment days times safety factor (Col. 6). The minimum deployment cost shown in column 7 is computed by using the minimum number of deployment days in column 6 and the ship cost data presented at the top of the page. Column 8 is obtained by multiplying column 7 by the safety factor. The average cost per buoy planted in column 9 is computed from the costs in column 7. The average minimum number of days required to deploy a buoy is shown in column 10 using the data from column 5. The last column lists the number of buoys that could be implanted by a ship operating at the rate specified in the heading for column 10 (335 days).

Three test summary pages are output for each deployment completed. The difference between the pages is the value used as the base cost per (ship) sea day.

1.1.4 Program Operational Information

The Integrated Buoy Deployment Cost Model is coded in the FORTRAN IV compiler language and has been developed and operated on an IBM 360/40 computer system. The program should operate in any other computer system with a FORTRAN IV compiler and operating system.

Detailed information on how to prepare the data cards and deck for the program is presented in Section 2.1; maintenance programmer details are presented in Section 3.1.

1.2 Procurement, Maintenance, and Replacement-Cost Model Computer Program

1.2.1 Program Function

Another buoy system cost model that was amenable to computer processing was the algorithm used to estimate hardware maintenance and replacement costs as a function of the item's initial procurement cost, expected lifetime and salvage value.

To do this, a series of items are read to describe the hardware and include:

(a) number of units of each item to be procured,

(b) cost per unit item,

(c) expected item lifetime, and

(d) item salvage value after expected lifetime.

From this information, the program computes the total initial procurement cost of m different items as

$$\text{Total Procurement Cost} = \sum_{1}^{m} (\text{unit cost}) \times (\text{number of units}). \qquad (1\text{-}2)$$

The pro-rated cost per year of operation to replace the item after its expected lifetime is computed by

$$\text{Replacement Cost/Year} = \frac{(\text{Procurement Cost}) - (\text{Salvage Value})}{(k)\ (\text{Lifetime})}, \qquad (1\text{-}3)$$

where k is an input factor that can be used to test the effect on the cost by changing the lifetimes by a fixed percentage. Using this cost, the annual maintenance cost is computed from the approximation:

$$\text{Maintenance Cost/Year} = 0.5\ (\text{Replacement Cost/Year}). \qquad (1\text{-}4)$$

In addition to the above cost values, the program also computes the number of units to be replaced annually by

$$\text{Replacement/Year} = \frac{(\text{Number of units of an item})}{(k)\ (\text{Lifetime})}, \qquad (1\text{-}5)$$

where k is the same lifetime factor described for Eq. (1-3).

1.2.2 Program Output

The output of this program is a listing of the hardware items, their cost characteristics, and the values computed for Eqs. (1-2) through (1-5). An example of this output is shown in Fig. 1-6.

RUN 1 20 JUN 68

TEST WITH LIFETIME FACTORS FROM 0.70 TO 1.30
DATA FROM DWN 51   DEPTH = 5000 M

AVERAGE ANNUAL REPALCEMENTS FOR 1 BUOYS

ITEM	NBR DPLY	LIFE (YR)		COST EACH		SALVAGE VALUE	REPLACEMENTS/YR NBR		REPLACEMENTS/YR COST
40' DISCUS HULL	1	20.0	$	80000.	$	0.	0.0	$	4000.
MOORING/100 FT	165	1.0	$	175.	$	0.	165.0	$	29875.
40' POWER SYSTEM	1	5.0	$	10000.	$	0.	0.2	$	2000.
DATA STORAGE	1	3.0	$	10000.	$	0.	0.3	$	3333.
DATA PROC.-SCAN.	1	4.0	$	15000.	$	0.	0.3	$	3750.
TIME CONTROL	1	5.0	$	1000.	$	0.	0.2	$	200.
BUOY TELEMETRY	1	5.0	$	15000.	$	0.	0.2	$	3000.
S/S SENSOR PKG	20	3.0	$	7000.	$	0.	6.7	$	46667.
AMBIENT NOISE	2	3.0	$	1000.	$	0.	0.7	$	667.
AMBIENT LIGHT	2	3.0	$	1700.	$	0.	0.7	$	1133.
TRANSPARENCY SEN	2	3.0	$	1100.	$	0.	0.7	$	733.
WAVE SENSOR	1	5.0	$	6250.	$	0.	0.2	$	1250.
ATMOS PRESS SNSR	1	5.0	$	500.	$	0.	0.2	$	100.
AIR TEMP SENSOR	1	5.0	$	400.	$	0.	0.2	$	80.
DEW POINT SENSOR	1	3.0	$	1300.	$	0.	0.3	$	433.
WIND VELCTY SNSR	1	2.0	$	600.	$	0.	0.5	$	300.
PRECIP RATE SNSR	1	5.0	$	500.	$	0.	0.2	$	100.
INSOLATION SENSR	1	5.0	$	500.	$	0.	0.2	$	100.
ATMOS ELEC SNSR	1	5.0	$	1000.	$	0.	0.2	$	200.
FUEL SUPPLY	1	5.0	$	200.	$	0.	0.2	$	40.
MOORING TENSION	1	3.0	$	500.	$	0.	0.3	$	167.
HULL TEMP	1	5.0	$	100.	$	0.	0.2	$	20.
BILGE WATER LVL	1	5.0	$	50.	$	0.	0.2	$	10.
MAG HEADING	1	5.0	$	300.	$	0.	0.2	$	60.
ANCHOR RELEASE	1	3.0	$	2500.	$	0.	0.3	$	833.
ANCHR,CHAIN, ETC	1	1.0	$	1000.	$	0.	1.0	$	1000.
NAV RADIO BEACON	1	5.0	$	5000.	$	0.	0.2	$	1000.
NAV LIGHT/HORN	1	5.0	$	500.	$	0.	0.2	$	100.

TOTAL INITIAL PROCUREMENT COST $ 328675.00

AVERAGE ANNUAL REPLACEMENT COST $ 100151.00

AVERAGE ANNUAL MAINTENANCE COST $ 50076.00

ANNUAL REPLACEMENT & MAINTENANCE $ 150227.00

Fig. 1-6. Output Example from the Procurement, Maintenance and Replacement Program.

1.2.3 Program Operational Information

This computer program is also written in the FORTRAN IV compiler language and has been developed and operated on an IBM 360/40 computer system. The program should operate in any other computer system with a FORTRAN IV compiler and operating system.

Detailed information on the preparation of the data cards and deck for this program are presented in Section 2.2; maintenance programmer information is presented in Section 3.2.

1.3 TDP 10-Year Financial Plan Computer Program

1.3.1 Program Description

One of the more cumbersome tasks encountered in the development of a Technical Development Plan (TDP) is to properly account for the many categories of information applicable to the various line items. For example, an entry for the line item "training ship-board buoy instruments technicians" can apply to such categories as personnel, training, seaborne support, instrumentation, OMN funds, etc. Obviously, with the frequent changes in initiation, scope and funding levels inherent in the preparation of a TDP, the desired summation of funds by categories can best be accomplished by means of a computer program.

The TDP 10-year Financial Plan computer program was developed to present detailed categorized funding information for yearly quarters and totals over a 10-year period. The user defines the "funding categories" applicable to the TDP analysis strategy. The line items in the TDP are collected under a user defined major activity or subactivity. The funding information for each group (subactivity) of line items is then assigned to the various funding categories as are applicable for the TDP analysis being conducted. The program reads in the data, collecting by month the various funding information applicable to each funding category. When finished, the program outputs the line items under their applicable headings and for each defined category, presents the accumulated costs by quarter, year, and for the 10-year period. A bar graph appears with the cost data to illustrate graphically the comparative expenditures for each quarter within a year, or the total expenditure for the year.

1.3.2 Program Input and Output

Basic inputs to the program are the category titles, major activity titles, the titles of subactivities under each major activity, and the line items with their funding schedule. The program lists all input data in the order in which it is used for ease of verifing the input data.

Figure 1-7 is an example of the category definition output page. In this example, 26 different categories were defined. Categories 2 through 23 could be one method of separating individual line item costs for further study. However, most of the line items applicable to categories 2 through 23 will also contribute to the total cost categories 1, 24, 25 and 26.

The input information for a subactivity of four line items is collected and listed as shown in Fig. 1-8. The major activity and subactivity headings that these items fall under are listed along with the funding schedule for each item. The cost allocation vector shown at the bottom is the "switch" used to indicate the categories to which the line items are applicable. In this example, the subactivity line items are applicable to Total Cost, Total Cost MK1, sensors (MK1) and Total Cost MK0 and MK1 (Cat. 1, 16, 17, and 24), as defined in Fig. 1-7.

The accumulated sum for each category is output as illustrated in Fig. 1-9. The bar graph to the right of each quarterly total is used to illustrate the rate of funding for the category for the year.

1.3.3 Additional Information

The main program is written in FORTRAN IV with an IBM 360/40 machine language subroutine to prepare the bar graph output. The program has been developed and tested on an IBM 360/40 system.

Section 2.3 presents further information on the program applicable for preparing data cards and running the job. Section 3.3 is additional information for a maintenance programmer.

1.4 The Buoy Component Characteristics Data File

During the initial phase of the 1967 TRC study of the feasibility of National Data Buoy Systems, an extensive survey was made of existing data buoys. Primarily, the information was collected and used to evaluate the 1967 state-of-the-art in buoy

COST VECTOR DEFINITION TABLE

CATEGORY	DEFINITION
1	TOTAL COST
2	TOTAL MANAGEMENT COST
3	PROJ MAN OFFICE
4	CONSULTANTS
5	TRAINING
6	COORDINATION
7	TOTAL RESEARCH COST
8	SENSORS
9	MAT AND COMPONENTS
10	GT LAKES AND ESTUARINE REQ
11	COOPERATIVE EFFORTS
12	TOTAL COST MK0
13	SENSORS (MK0)
14	HULL AND MOORINGS (MK0)
15	SEABORNE SUPPORT (MK0)
16	TOTAL COST MK1
17	SENSORS (MK1)
18	HULL AND MOORINGS (MK1)
19	SEABORNE SUPPORT (MK1)
20	SHORE SUPPORT (MK1)
21	TOTAL COST MK2
22	SENSORS (MK2)
23	HULL AND MOORINGS (MK2)
24	TOTAL COST MK0 AND MK1
25	TOTAL COST SEABORNE SUPPORT
26	TOTAL COST SHORE SUPPORT

Fig. 1-7. Category and Cost Vector Definition Table.

```
MAJOR ACTIVITY- MK1

  SUB-ACTIVITY- SENSORS

   YR            PROGRAM

   69-14D DEV MK1 SENSORS                            START MONTH =      9
                                                      STOP MONTH =     12
                                                         FUNDING =$    0K
                                               AVG FUNDING/MONTH =$    0K

   70- 2T LAB TESING SENSORS                         START MONTH =     14
                                                      STOP MONTH =     24
                                                         FUNDING =$  400K
                                               AVG FUNDING/MONTH =$   36K

   70-18D ENG DEV MK1 SENSORS                        START MONTH =     13
                                                      STOP MONTH =     28
                                                         FUNDING =$ 1000K
                                               AVG FUNDING/MONTH =$   63K

   71- 2T LAB TESTING SENSORS                        START MONTH =     25
                                                      STOP MONTH =     34
                                                         FUNDING =$  300K
                                               AVG FUNDING/MONTH =$   30K

   COST ALLOCATION VECTOR -

        CATEGORIES  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
                    1  0  0  0  0  0  0  0  0  0  0  0  0  0  0

        CATEGORIES 16 17 18 19 20 21 22 23 24 25 26
                    1  1  0  0  0  0  0  0  1  0  0
```

Fig. 1-8. Line Items with Funding Schedule and Activity Headings.

TOTAL COST MK1

YEAR	TOTAL ($K)	QUARTER	QUARTERLY ($K)
1969	900	1	157
		2	157
		3	277
		4	310
1970	9233	1	1946
		2	1680
		3	1642
		4	3965
1971	51592	1	10767
		2	12061
		3	14404
		4	14359
1972	48660	1	12332
		2	12582
		3	12332
		4	11415
1973	6230	1	813
		2	1813
		3	1813
		4	1789
1974	0	1	0
		2	0
		3	0
		4	0
1975	0	1	0
		2	0
		3	0
		4	0
1976	0	1	0
		2	0
		3	0
		4	0
1977	0	1	0
		2	0
		3	0
		4	0
1978	0	1	0
		2	0
		3	0
		4	0
		TOTAL	$116615

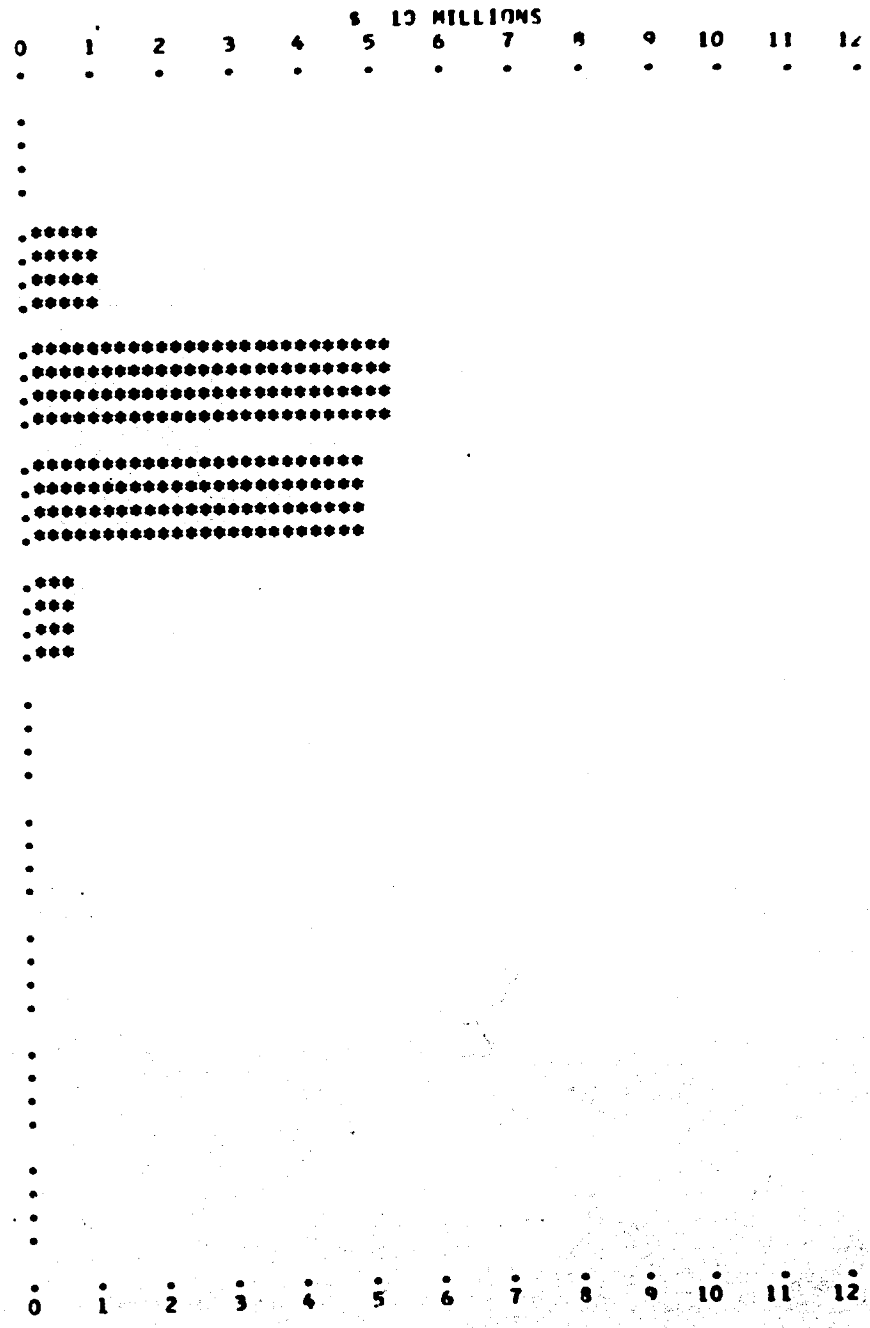


Fig. 1-9. Accumulated Cost for a Category (Number 16 in Fig. 1-7).

technology The resulting data base was presented in a compact code format.[2] Under the present contract, TRC undertook to standardize these data as much as possible and reformat the data base for subsequent computer processing. The following paragraphs describe the work completed on these data and presents the characteristics of the reformatted data base. (Note: No effort has yet been made to update, or change, the data content from that tabulated in early 1967.)

The data collected were organized into 32 categories of data buoy components as listed in Table 1-2. The variety of individual characteristics required to fully describe these components is listed in Table 1-3. Obviously, any single component can have only a small subset of the 84 characteristics listed in Table 1-3, and it is necessary to have a specific component in mind in order for the entries in Table 1-3 to be applicable. Only the first five characteristics are common to all components except for the meteorological and oceanographic sensors which have eleven common characteristics.

The 1967 data have been processed into a two-dimensional matrix of components versus characteristics with entries in the table elements where the information was applicable and available. The matrix is on magnetic tape and is available for further computer processing use. Section 3.4 describes, in programmer language, the format of this data file. Appendix A is a lising of this data tape.

1.5 Fleet Numerical Weather Central Depth Data

In order to determine the number of subsurface sensor packages and the amount of mooring required for each buoy, it is necessary to have a reasonable estimate of the water depth at each buoy location selected Routine ocean depth charts present this information, but on rather coarse "grid" for some areas. Another problem with available map data is the possibility for making interpolation errors when reading values. The Fleet Numerical Weather Central (FNWC, formerly Fleet Numerical Weather Facility) has ocean depth data on an approximately 20 n. mi square grid for most of

[2] Walden, R. G. and E. J. Aubert, 1967: Buoy and Buoy Components Data Compilation and Analysis, Vol. I, Part 2, TRC 7485-256, The Travelers Research Center, Inc., Hartford, July.

TABLE 1-2
BUOY COMPONENTS

Hull surface
Hull, subsurface
Pitch and roll sensor
Acceleration sensor
Vibration sensor
Mooring, tether
Mooring, main
Tensiometer sensor
Mooring depth control equipment
Acoustic release sensor
Power system, battery
Power systems, other
Data storage
Data processor
Interrogation
Telemetry
Time control equipment
Sensor scanner
Magnetic sensor
Atmospheric pressure sensor
Air temperature sensor
Dew point sensor
Wind velocity sensor
Precipitation sensor
Solar radiation sensor
Depth sensor
Current velocity sensor
Water temperature sensor
Salinity/conductivity sensor
Acoustic transponder
Acoustic sensor

TABLE 1-3
BUOY COMPONENT CHARACTERISTICS

Buoy identification	Output, direction	Auxillary floats
Data available	Power requirements	Ballast material
Manufacturer	Biological immunity	Ballast weight
Model number	Breaking strength	Modulation type
Cost	Buoyancy material	Band width
Reliability	Carrier frequency	Capacity A/H
Type	Direction reference	Charging system
Range, low	Displacement	Efficiency
Range, high	Electrical integrity	Data rate
Accuracy	Frequency	Draft
Output characteristics	Lateral displacement	Fuel
Size	Medium	Interrogate security
Weight	Resistance to corrosion	Mast height
Diameter	Corrosion protection below	Mast diameter
Length	Stretch to break	Mooring depth control
Height	Time constant	Redundancy
Width	Scope	Storage code
Depth limits	Buoyancy	Storage type
Survivability	Corrosion protection above	Reel capacity
Construction	Power output	Sampling rate
Material	Anchor release	Scan rate
Capacity	Anchor type	Static stability angle
Code type	Anchor weight	Swivels
Accuracy, speed	Anchor cost	Total mooring cost
Accuracy, direction	Anchor chain	Transmit interval
Type, speed	Antenna	Transmit duration
Type, direction	Average time, speed	Power
Output, speed	Average time, direction	Function

the ocean areas. The U.S. Coast Guard requested that FNWC forward their ocean depth data to TRC to make available a numerical tabulation of ocean depth data.

The data received from FNWC were magnetic tapes of packed coded depth* data. These values effectively describe the representative ocean depth within a 20-minute square of latitude and longitude. As received, the data were not in a format that could be easily used for manual processing. For this reason, TRC unpacked, decoded, reformatted and listed the original FNWC depth data. Buoy depth data can now be obtained by looking through the listing for the appropriate representative maximum and minimum depth value for points within a 0.33° latitude-longitude square. Appendix B is the listing of this reformatted data. The most serious limitation of the data is that there are values only for the southwest quarter of the North Atlantic.

*A magnetic tape describing ocean bottom roughness on a 1-degree grid was also received but not used by TRC.

2.0 COMPUTER PROGRAMS OPERATING INSTRUCTIONS

2.1 Integrated Buoy Deployment Cost Model

The buoy deployment program is the required tool for computing the assortment of time and cost values relative to a buoy system deployment. Basically, a buoy network is specified and the great circle distance between significant points are computed. From the total cruise distance traveled, a variety of time and cost values are computed as functions of possible ship capabilities and costs. In gross terms, the program processes the information in a number of independent user-controlled processing cycles, as directed by input control cards. When all processing cycles of the basic data have been completed, new basic data may be read in and another series of processing cycles begun. The program is highly generalized within a deployment oriented framework and allows the user to evaluate almost any "first-generation" buoy deployment strategy. For further general external features of the program, and examples of program outputs, the reader should refer to Section 1.1.

Input to the deployment model is complex due to the variety of information that is needed for each computer run. With this in mind, a concerted effort was made to make the operation of the program as straightforward as possible. A modest degree of success has been achieved toward this goal; however, the program user is cautioned to check carefully the data card punching and the sequence of input data cards.

There are four basic concepts built into the deployment program to reduce the bulk and complexity of the data preparation task. These are:

(a) Identify all cards by obvious card names that are punched onto the cards.

(b) Build constant values into the program for routine variables so that the internal constant will be used unless a new value is input.

(c) Allow the program to recycle through basic data without repeating previously specified data values.

(d) List all input as part of the output so that subsequent re-runs or corrections can be made easily.

Consonant with item (a), all input cards have given short names and are identified by that name by the program and throughout the remainder of this documentation.

Section 3.1 presents additional information on this computer program that is primarily of interest to a maintenance programmer.

2.1.1 Input Data Cards

The following paragraphs define the format for each program data card. The order in which they are described is not necessarily the order in which the cards are read in by the program.

All data values must be adjusted to the right so that the right-most digit falls into the right-most column of the data field for the variable (except for PORT, DEPOT, and SHIP name). An F, I, or A is given for each variable to define the format of the data. This code is as follows:

> F = Data are in floating point and require a decimal point.
>
> I = Data are integers without a decimal point.
>
> A = Data are alphanumeric characters.

Data in capital letters in the "Contents" column mean those exact characters are to be punched on the input card.

As previously mentioned, certain constants have been built into the program, making it unnecessary to input a value for that variable every time the program is run. In describing the card formats, those variables that have a built-in constant are indicated by having the constant value presented in parenthesis following the description of the variable.

Deploy Control (DEPLOY) Card. The first data card indicates that deployment data cards follow. The format is:

Columns	F/I/A	Contents
1-15	A	DEPLOY STARTING
17-18	I	Day to start deployment
20-22	A	Month to start deployment. Characters must agree with one of the first twelve names punched on the next (alpha) card.
24-25	I	Last two digits of the year.
27-28	A	AT
30-33	I	Hour to start deployment, using the 24-hr clock.
35-37	A	HRS
41-54	A	IMPLANT INCR
56-57	I	Δt_1, in hours,* normally zero
59-60	I	Δt_2, in hours*
62-63	I	Δt_3, in hours*
65-66	I	Δt_4, in hours*

Alpha Input Card. This card provides needed sets of alphabetic characters so the program can recognize subsequent control words.

Columns	F/I/A	Contents
2-48	A	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
51-55	A	NEWSM
58-68	A	STOPNEXTNEW
70-73	A	NAVP

---

*The program requires four "time-to-implant-a-buoy" values. The base time, T, is specified on the SHIP card. The four values t_1 to t_4 that are used are computed as follows:

$$t_1 = T + \Delta t_1 \qquad t_3 = t_2 + \Delta t_3$$

$$t_2 = t_1 + \Delta t_2 \qquad t_4 = t_3 + \Delta t_4$$

Ship Speed-Cost (SPCST) Card. The cost per n. mi.steamed by a ship and a maintenance cost to be added to the basic ship sea-day cost must be input for each ship size (buoy capacity) and speed. This is done by the SPCST card.

Columns	F/I/A	Contents
1-5	A	SPCST
7-10	F	Ship Speed
12-13	I	First buoy capacity
16-18	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy capacity.
20-24	F	Cost per n. mi.steamed
26-27	I	Next buoy capacity
29-32	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
34-38	F	Cost per n. mi. steamed.
40-41	I	Next buoy capacity.
43-46	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
48-52	F	Cost per n. mi.steamed.
54-55	I	Next buoy capacity.
57-60	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
62-66	F	Cost per n. mi.steamed.
68-69	I	Last buoy capacity.
71-74	I	Daily additive cost to the basic ship sea-day cost for ship of this speed and buoy-carrying capacity.
76-80	F	Cost per n. mi.steamed.

There must be 8 of the above cards, one for each ship speed to be used. If less than 8 speeds are of interest, the last valid SPCST card can be repeated to complete the set of 8.

The SPCST cards define the possible ship speeds and buoy-carrying capacities that can be used during the run. The buoy-carrying capacity punched on the SHIP card must match a buoy-carrying capacity entered on the SPCST cards.

Run Number Card. This card contains a run number and date by which the output pages can be collected and identified. It also contains an option to suppress the printing of the results for individual ship speeds.

Columns	F/I/A	Contents
1-3	I	Run Number
5-6	I	Day of the run
8-10	A	Month of the run
12-13	I	Year of the run
14-72	A	These columns must be left blank
73	I	Print option code,* ship speed 1
74	I	Print option code,* ship speed 2
75	I	Print option code,* ship speed 3
76	I	Print option code,* ship speed 4
77	I	Print option code,* ship speed 5
78	I	Print option code,* ship speed 6
79	I	Print option code,* ship speed 7
80	I	Print option code,* ship speed 8

The run number is automatically incremented for certain processing cycles.

Heading Cards. There are two heading cards input and printed at the top of each output page. The format of both of the cards is:

Columns	F/I/A	Contents
1-65	A	Any set of alphanumerics
66-80	A	Blank

*Print option code.

1 Do not print calculations

blank — Print calculations for that ship speed.

PORT Card. This card specifies the port location for the deployment ship. All cruises will begin and end at this port location.

Columns	F/I/A	Contents
1-4	A	PORT
8-9	I	A consistent port/depot number.
15-26	A	Port name.
29-32	F	Port latitude to the nearest tenth of a degree.
33	A	N or S for port latitude
35-39	F	Port longitude to the nearest tenth of a degree.
40	A	E or W for port longitude
42-43	I	Minimum days the ship must spend in port after each cruise. (4)*
45-46	I	The maximum days a ship can spend in port after each cruise. (10)*
48-49	I	The average number of days per year that the ship will not be available to implant buoys, normally the time the ship is in port for major overhaul. (30)*

DEPOT Card. This card tells the program where it is to on-load buoys. The depot location does not have to be the same as the port. If the two are the same, the port number and the depot number (columns 8-9) must be identical.

Columns	F/I/A	Contents
1-5	A	DEPOT
8-9	I	A consistent port/depot number
15-26	A	Depot name
29-32	F	Depot latitude to the nearest tenth of a degree.
33	A	N or S for depot latitude
35-39	F	Depot longitude to the nearest tenth of a degree.
40	A	E or W for depot longitude.

*Built-in constant.

SHIP Card. The ship card contains the ship constants to be used for a processing cycle. Although there are many constants defined on the card, it is possible to use the program's automatic assignment of values and not include a value for all items. To use a built-in constant value, simply leave that field blank. The value used will be the value shown in the parenthesis following the description of the variable.

Columns	F/I/A	Contents
1-4	A	SHIP
9-20	A	User preferred ship name or identification.
23	I	0 = Do not print cruise summary page 1 = Do print cruise summary page (blank = do not print)
33-34	I	Ship maximum buoy carrying capacity. There is no built-in value for this field.
36-37	I	Desired total number of sea-days per cruise. (30)
39-40	I	Maximum allowed sea-days per cruise. (99)
42-43	I	The minimum time required to implant a buoy. This is the time T used with entires on the DEPLOY control card. (12)
45-48	F	Overall safety factor used to multiply the minimum time and cost computations. (1.33)
55-58	F	The fraction of a ship sea-day cost that is to be used as the ship port-day cost. (0.94)
60-64	I	Minimum base cost, in dollars, for a ship sea-day. (2000)
66-70	I	Second base cost, in dollars, for a ship sea-day. (5000)
72-76	I	Maximum base cost, in dollars, for a ship sea-day. (8000)

The ship buoy-carrying capacity in columns 33-34 must match one of the buoy-carrying capacities included on the SPCST cards:

Buoy Cost (COST) Card. The costs associated with the buoy hardware are specified on this card.

Columns	F/I/A	Contents
1-4	A	COST
7-12	I	Buoy hardware cost except for subsurface sensors and mooring. (158000)
15-19	I	Cost for each buoy subsurface sensor package. (7000)
22-26	I	Cost for mooring per 1000 ft. (1750)
30-33	F	Mooring scope. (1.00)

BUOY Card. The location of each buoy to be deployed is input via a BUOY card.

Columns	F/I/A	Contents
1-4	A	BUOY
6-9	A	Buoy identification characters.
23-26	F	Buoy latitude to the nearest tenth of a degree.
27	A	N or S for the latitude.
29-33	F	Buoy longitude to the nearest tenth of a degree.
34	A	E or W for the longitude.
36-40	I	Water depth in feet or meters.
41	A	Units code for depth value in columns 36-40. M = depth in meters blank = depth in feet
43-48	I	Buoy hardware cost to override the cost on the COST card for this buoy. (If blank, cost is taken from the COST card.)

Navigation Check Point (NAVP) Card. It is sometimes desirable to have the deployment program sail to certain navigation check points. These are necessary to have the deployment ship sail around islands and peninsulas, since distances are computed on a great circle (straight line) basis. These navigation check points are input as follows:

Columns	F/I/A	Contents
1-4	A	NAVP
6-9	A	Point identification.
23-26	F	Latitude to the nearest tenth of a degree.
27	A	N or S for the latitude.
29-33	F	Longitude to the nearest tenth of a degree.
34	A	E or W for the longitude.
50-80	A	Available for comments.

LOAD Card. This card specifies the number of buoys to be deployed per cruise. No entry on the LOAD card can exceed the ship buoy-carrying capacity given on the SHIP card.

Columns	F/I/A	Contents
1-4	A	LOAD
6-7	I	Number of buoys to be deployed on the first cruise.
9-10	I	Number of buoys to be deployed on the second cruise.
12-13	I	Continued as necessary to include the loads for up to the first 25 cruises.
15-16	I	
18-19	I	
⋮		
79-80	I	

If a deployment strategy calls for 25 or more cruises, it is necessary to include a second LOAD card. The second LOAD card does not have the name punched on the card but uses 26 fields of 3 columns each; this allows a maximum of 50 cruises to be specified. (Note: there will always be a blank load field after the last cruise load. This is why a second (blank) card must be used if there are exactly 25 cruises.)

Navigation Points Per Cruise (NPPC) Card. The number of navigation points that must be used for each cruise are specified on this card. There must be an entry on this card(s) for each cruise specified on the LOAD card.

Columns	F/I/A	Contents
1-4	A	NPPC
6-7	I	Number of navigation points for the first cruise.
9-10	I	Number of navigation points for the second cruise.
12-13	I	Continued as necessary to include the first 25 cruises.
15-16	I	
18-19	I	
.		
.		
79-80		

If all of the navigation points for each cruise can not be included on a single card (i.e., over 25 cruises), a second NPPC card is punched in the same format as the first.

Stop Buoy Input (STOP) Card. A combined total of up to 200 buoys and navigation cards can be input at one time. However, since the number of cards input is not fixed or specified, it is necessary to flag the end of the BUOY and NAVP cards with the following control card.

Columns	F/I/A	Contents
1-20	A	STOP BUOY/NAVP

Deployment Order (ORDER) Card. The buoy and navigation point cards are stored in an internal array in the order in which they are read. Normally, this order is a sort on the identification in columns 6-9 of the cards. The order in which these buoys are to be deployed generally bears no resemblence to these identification numbers. Therefore, ORDER cards are used to specify the order in which the buoys are to be deployed.

Columns	F/I/A	Contents
1-5	A	ORDER
6-8	I	The input sequence number of the buoy card or navigation point card that is to be used first.
9-11	I	The input sequence number of the buoy card or navigation point card that is to be used second.

Columns	F/I/A	Contents
12-14	I	Third input sequence number, etc.
15-17	I	Continued as necessary to specify up to 25 BUOY and/or NAVP cards input sequence numbers.
18-20	I	
21-23	I	
.		
.		
.		
78-80		

If all BUOY/NAVP cards to be used can not be included on one card, additional ORDER cards are prepared, in the same format, until all points have been specified. Note that a single BUOY or NAVP card can be used as many times as desired.

Next Ship (NEXT) Card. Normally, a set of buoys is deployed using a series of ships, each with a different buoy-carrying capacity. The NEXT ship card is used to indicate that the array of BUOY and NAVP data are to be deployed by a different ship.

Columns	F/I/A	Contents
1-9	A	NEXT SHIP

This card can also be used to indicate just a change in deployment order; however, the deployment ship characteristics must be restated.

New Buoys (NEW) Card. When all deployments on a set of BUOY/NAVP cards have been completed, it is possible to read in another set of cards and repeat the same cycle. This is indicated by the following card.

Columns	F/I/A	Contents
1-9	A	NEW BUOYS

THE END Card. The following card signals the end of all input data.

Columns	F/I/A	Contents
1-12	A	THE END

2.1.2 Data Deck Preparation

Data cards for the deployment model program are prepared from a specified buoy deployment strategy. Generally, the BUOY and NAVP cards are prepared to conform to a desired buoy network configuration, from some form of a buoy location, or cruise map. The ORDER in which the buoys are to be deployed is determined, which also defines the LOAD per cruise and the navigation points per cruise (NPPC). The various ship characteristics are defined and punched for the SHIP card. These cards, combined with the general information and control cards, make up the data deck.

The data cards are read in the order given in Table 2-1. A complete set of each type of data card is read to initiate the program and process a set of data for one ship. After the STOP BUOYS card there must be an option control card. If another ship is to be used, a NEXT SHIP card is followed by the four cards SHIP, LOAD, NPPC and ORDER to define the next deployment strategy. This same sequence is used in just the order in which the buoys are to be deployed is to be changed. When all ship and order strategies have been completed on a set of BUOY and NAVP cards, a new set of these data can be input by giving a NEW BUOYS card, which is followed by the series of cards shown in the last column in Table 2-1.

As can be seen from Table 2-1, the starting deployment date and the hours-to-implant-a-buoy increments input on the DEPLOY card are used for all cycles for that computer run. The ship operation costs input on the 8 SPCST cards are input once and also used for all computations in the run.

The run number is automatically increased by one each time a NEXT SHIP card is read. A new run card is input if new buoys are to be used and thus an opportunity to input a new run number.

The use of NAVP cards is optional. These cards, when included, follow the last BUOY card and precede the STOP BUOYS card. Even if NAVP cards are not used, the right number of (blank) NPPC cards must still be included.

It is not necessary to use all input BUOY and NAVP cards on each ship cycle.

A listing of the data card deck used to generate Figs. 1-1 through 1-5 is presented as Appendix C.

TABLE 2-1
INPUT SEQUENCE FOR REQUIRED DATA CARDS

Card Short Name	For First Ship Processing	To Change Ship and/or Dplymt. Order	Input New Buoys
DEPLOY	Yes		
Alpha	Yes		
SPCST (8 cards)	Yes		
Run	Yes		Yes
Heading (Line 1)	Yes		Yes
Heading (Line 2)	Yes		Yes
PORT	Yes		Yes
DEPOT	Yes		Yes
SHIP	Yes	Yes	Yes
LOAD	Yes	Yes	Yes
NPPC	Yes	Yes	Yes
ORDER	Yes	Yes	Yes
COST	Yes		Yes
BUOY	Yes		Yes
NAVP (Optional)	Yes		Yes
STOP	Yes		Yes
1 of the next 3 option cards must follow each cycle			
NEXT SHIP	if yes, then		
	or		
NEW BUOYS	if yes, then		
	or		
THE END	if yes, the program terminates		

2.1.3 Program Input Restrictions

A reasonable limit was necessary on the number of cards of one type that can be input within a processing cycle. These limits, and in some cases the mandatory number, are as follows:

(1) The maximum number of different times-to-implant-a-buoy is 4.

(2) The maximum and mandatory number of ship speeds is 8.

(3) The maximum number of different ship buoy-carrying capacities is 5.

(4) The maximum and mandatory number of ports is 1.

(5) The maximum and mandatory number of depots is 1. If the port and depot are the same, their respective identification numbers must be the same.

(6) The maximum number of basic ship sea-day costs is 3.

(7) The maximum number of ship cruises per ship is 50.

(8) The maximum total number of BUOY cards plus NAVP cards is 200 per STOP BUOY card.

(9) The maximum total number of buoy locations plus navigation points used per ship cycle is 300. For example, if there are 180 BUOY cards and 10 NAVP cards, this is less than 200 and satisfies limit (8). The 10 different navigation points, however, can be used only up to 120 times since the total number of points used (180 + 120) cannot exceed 300.

2.1.4 Program Operation

2.1.4.1 Equipment Required

The program is written in FORTRAN IV and was developed and tested using the IBM 360/40 Disk Operating System. A compilation of the program requires about 7 minutes. The program uses about 49,000 bytes of storage and requires a central processor, a card reader and an output printer to be run.

2.1.4.2 Error Messages and Aborts

The program has two programmed error messages. If the number of sea days for a cruise exceeds the maximum value input on the SHIP card, the message

EXCEEDED MAX NBR OF SEA DAYS TO IMPLANT BUOY aaxx
REORDER BUOYS AND DO ANOTHER DEPLOYMENT

is output, where aaxx is an input BUOY card identification. Following this message, the program aborts. The other error message,

> COST VALUES NOT IN COST TABLE FOR SHIP BUOY CAPAVITY = ii, CHECK INPUT CARDS AND TRY AGAIN

occurs if the ship buoy-carrying capacity on the SHIP card does not match with a ship buoy-carrying capacity on the SPCST cards. Further processing is also aborted if this occurs.

The program will abort if the data cards are improperly punched. An abort will also occur if the data deck card sequence is bad and causes the program to attempt to read a data field that is not compatible with the card being read. To locate these types of errors, review the last satisfactory cycle of data. The error is usually obvious as the aborting point is indicated by the termination of the printed output.

2.1.4.3 Recovery Procedures

There are no recovery points in the program. When an abort does occur, recovery is accomplished by restarting the processing cycle at, or prior to, the point where the error occurred.

2.1.4.4 Running Time

The program operates on the IBM 360/40 system at essentially the speed of the printer. Since the minimum output possible is:

1 Constants Page,

1 Buoys Page,

1 System Deployment Summary Page, and

3 Deployment Test Summary Pages,

the minimum running time is about 30 seconds regardless of the number of buoys to be deployed. Only a small additional time (of the order of five seconds) is required to read in the data cards and do the computations.

2.1.4.5 Error Checking Procedures

It is sometimes necessary to input a large amount of data to the program. Even after personnel are experienced in preparing the data and the program, the possibility of an error cannot be reasonably discarded until the data and results have been carefully checked. Experience with the program has indicated the following procedures can help reduce the number of bad computer runs.

(a) Develop a file of correctly punched standard cards, such as SHIP, PORT, DEPOT, etc. Use these cards as much as possible to avoid errors when punching new cards.

(b) Obtain a simple card listing of the data deck when it is considered complete and ready. Use this listing and Table 2-1 to validate the sequence of the data cards.

(c) From the listing made in (b), check the order the buoys are to be deployed against the cruises planned for each ship. At the same time, check the LOAD, NPPC and ORDER cards for the right total number of entries. The number of entries on the order cards must equal the sum of the values on the LOAD and NPPC cards.

(d) Use the listing to verify the correct punching of the BUOY cards. Be sure the BUOY cards are in the order desired. Check the latitude, longtitude and depths on the BUOY cards for obvious errors; be sure M follows those depths given in meters. Verify the positions cut on the NAVP cards.

After the run has been made, it is desirable to review the results prior to delivery to the user. The following steps are suggested as part of this review.

(a) Values on the constants page should be verified as those values desired for the run.

(b) The list of buoys in the order they are deployed should be scanned. Investigate large changes in latitude and/or longtitude between successive buoys if they do not occur between the end of one cruise and the start of the next. This order can also be verified against the planned cruise map for that ship. Be sure the total number of buoys to be deployed is as planned. Note that navigation points <u>do not</u> appear on this list.

(c) Review the Cruise Summary Pages for strange distances between successive points. Navigation points <u>are</u> listed with this output. Be sure each cruise begins and ends as planned.

(d) The System Deployment Summary Page is used to compare one cruise against the other. Normally, the distance traveled per cruise should be roughly the same. If one cruise is unusually longer or shorter then the others, determine if it was correct. as suggested in (b) and (c) above.

(e) The Deployment Test Summary Pages contain the ship speeds, ship operating costs constants and the four values used as the times to implant a buoy. Validate these constants and check results for reasonableness.

Additional error recovery procedures are presented in Section 2.1.4.3.

2.2 Procurement, Maintenance, and Replacement-Cost Model Computer Program

2.2.1 Introduction

This cost model reads a deck of buoy component data cards that contain the name, number of units, expected lifetime, initial cost, and salvage value for each hardware item to be considered. From these data, the program computes, for each item:

$$\text{Initial Procurement Cost} = (\text{item cost}) \times (\text{number of items}), \qquad (2\text{-}1)$$

$$\text{Replacement Cost/Year} = \frac{(\text{Int. Proc. Cost}) - (\text{Salvage Value})}{(k)\ (\text{Lifetime})}, \qquad (2\text{-}2)$$

$$\text{Maintenance Cost/Year} = 0.5\ (\text{Replacement Cost/Year}), \text{ and} \qquad (2\text{-}3)$$

$$\text{No. of Replacements/Year} = \frac{(\text{Number of units of the item})}{(k)\ (\text{Item lifetime})}, \qquad (2\text{-}4)$$

The input factor k in Eqs. (2-2) and (2-4) makes it possible to recycle through a deck of items and compute new values by changing the lifetime of each item by a constant percentage.

2.2.2 Input Cards

All data values are to be adjusted to the right so that the right-most digit falls into the right-most column of the data field for the variable. An F, I or A is given for each variable to define the format code of the data as follows:

F = Data are in floating point and require a decimal point.

I = Data are integers and without a decimal point.

A = Data are alphanumeric characters.

Data in capital letters in the "Contents" column mean those exact characters are to be punched on the input card

Card 1-Option Control Card. The first card in the data card deck must be as follows:

Columns	Contents
1-12	STOPRECYCHAN

This provides the input necessary to detect subsequent program control words.

Card 2-System Specification Card. The next card defines the number of buoys for which to compute costs and the lifetime adjusting factor k for Eqs. (2-2) and (2-4).

Columns	F/I/A	Contents
1-12	A	REPLACEMENTS
14-16	I	Number of buoys for which to compute costs
18-22	A	BUOYS
25-41	F	LIFETIME FACTORS
43-45	F	Lifetime modifying factor k. (If blank, k = 1.0)

Card 3-Run Card. This card identifies the run with a run number and date.

Columns	F/I/A	Contents
1-4	A	RUN
5-6	A	Run number
12-20	A	Day-month-year

Card 4 and 5-Title Cards. Two alphanumeric cards are input to describe the run.

Columns	F/I/A	Contents
1-64	A	Any alphanumeric characters

Card 6-Item Data. This is the card used to input the pertinent data about each hardware item.

Columns	F/I/A	Contents
1-16	A	Item Name
21-24	I	Number of items/buoy. If blank, the number of buoys in the system from card 2 is automatically inserted here.
25-29	F	Expected item lifetime in years
32-39	F	Cost of an item in dollars
42-47	F	Salvage value in dollars

One of these cards is prepared for each hardware item included in the system. The maximum allowed number of these item cards is 50.

Card 7-End-of-Items Card. The following control card must follow the last item card:

Columns	Contents
1-15	STOP ITEM CARDS

Card 8a-Option: Recycle Card. To change the lifetime of the items, the following card is used:

Columns	Contents
1-7	RECYCLE

This card must then be followed by cards 2, 3, 4 and 5

Card 8b-Option: Change Item Cards. This card is used to change the contents of the item deck, and is used in place of card 8a.

Columns	Contents
1-17	CHANGE ITEM CARDS

Cards 9, 6, 2, 3, 4 and 5 must then immediately follow this card.

Card 8c-Option: End Run. The following card is used to terminate the computer run.

Columns	Contents
1-7	THE END

Card 9-Item Modification Control Card. This card is used in conjunction with card 8b to specify changes to the previous item card deck. The format of this card is:

Columns	F/I/A	Contents
1-2	I	Number of item cards to be changed
4-5	I	Sequential number of the first item card to be changed
7-8	I	Sequential number of the second item card to be changed
⋮		
78-80	I	Sequential number of the 26th item card to be changed

If more card changes are needed, continue the sequential numbers on another card, starting in columns 2 and 3. Following the last card 9 must be the number of new item cards (card 6) that is specified in columns 1 and 2 of the first card 9. These modifying item cards must contain a number in columns 21-24 as the automatic number insertion feature is not available at this point in the program. The card immediately following the last new item card must be an option control card 8a, 8b, or 8c. (Note: The original total number of item cards must remain constant through all change cycles.) The data deck used to produce Fig. 1-6 is presented as Appendix D.

2.2.3 Information and Expected Output

The complete program and data deck are assembled as specified for a normal FORTRAN IV input deck. The data cards must be in the order specified in the preceding section.

Output from the program is one page per cost computation cycle. The program requires a central processor, card reader, and printer. The program operates at printer speed, thus requires about four seconds per complete computation cycle.

There are no program error or diagnostic messages. An output data error will be due to either improper punching of the cards or in sequencing the data cards. Recovery from these errors is accomplished by correcting the data and rerunning the program from the last appropriate valid data cycle.

2.3 TDP 10-Year Financial Plan Program

2.3.1 Introduction

This program is a means of assigning the time-phased funded line items in a TDP to applicable user-defined categories. This information is input to the program by means of cards that are of three possible "levels" of information. These levels are: (1) a major activity, (2) a subactivity, and (3) line items under a subactivity. This data structure is illustrated in Fig. 2-1. As the data cards are read, they are collected under their appropriate headings and the cost information allocated to the designated categories. When all input data have been read the accumulated totals for each category are listed by quarterly and yearly totals for the 10-year period.

2.3 Input Data Cards

Prior to the use of the program, it is necessary to structure the TDP data much as outlined in Fig. 2-1. Once this has been accomplished, and the categories defined, the data cards are cut and input essentially as illustrated in Fig. 2-1.

The different types of input cards to the program are defined in Table 2-2. Note that all numbers input are without a decimal point and are right adjusted within a data field. The values for starting and ending months on card 10 is based on a 120-month period; therefore, the first month in the second year is input as month 13, the last month of the tenth year is month 120, etc.

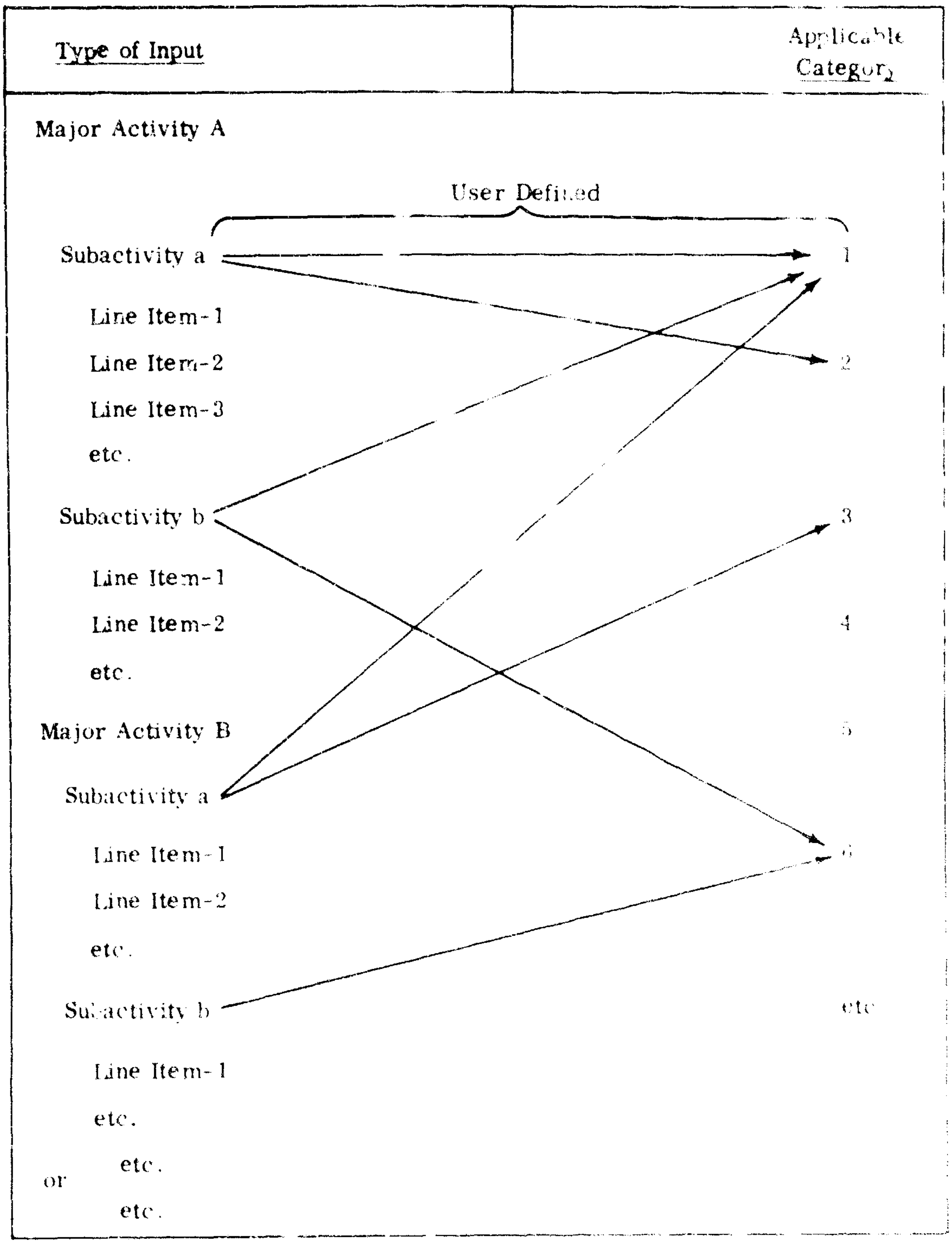


Fig. 2-1. Schematic illustration of the relationship between the program's various levels and type of data.

TABLE 2-2
FORMAT OF THE INPUT CARDS TO
THE TDP 10-YEAR FINANCIAL PLAN PROGRAM

Card	Columns	Contents
1	1-5	Total numbers of categories
	10	Code as follows: blank Bar graph for quarterly totals 1 Bar graph for yearly total
2	1-80	A category title
3	1-5	Number of major activities
4	1-80	A major activity title
5	1-5	Number of subactivities in a major activity
6	1-80	A subactivity title
7	This card contains the cost allocation codes to indicate to which category the line items within the subactivity are to be applied. Code as follows: 0 Do not allocate the line item(s) in this subactivity to the category 1 Allocate all the line items in the subactivity to the category	
	2 Code for category 1	
	4 Code for category 2	
	. . .	
	54 Code for category 27	
8	1-5	Number of line items in the subactivity
9	1-40	Line item description
10	3-5	Funding schedule starting month number (1 to 120)
	8-10	Funding schedule ending month number (1 to 120)
11*	1-12	Dollars funded for first month of spending
	13-24	Dollars funded for second month of spending

*See text (continued next page)

TABLE 2-2 (Continued)

Card	Columns	Contents
11*	25-36	Dollars funded for third month of spending
	37-48	Dollars funded for fourth month of spending
	49-60	Dollars funded for fifth month of spending
	61-72	Dollars funded for sixth month of spending
11a*	1-12	Dollars funded for seventh month of spending
	.	
	.	
	61-72	Dollars funded for twelfth month of spending
11b*	1-12	Dollars funded for thirteenth month of spending
	.	
	.	
	.	

*See text.

The funding schedule for a line item can be input in one of two modes. The first is to specify a total amount that is to be spent over a fixed period. In this mode, the program divides the total into equal amounts that are assigned to each month in the period. The other method of scheduling funds is to input the amount to be spent for each individual month. This approach requires the use of the optional cards 11, 11a, 11b, etc. Note, however, that if individual monthly amounts are to be used, the dollar value on card 10 must be zero and there must be enough cards 11, 11a, 11b, etc. to include the amount for each month indicated on the card 10.

Table 2-3 is an outline of a data deck showing the order and required quantity for each card listed in Table 2-2. Notice how the values punched on certain cards determine how many of another type of card must be input. Appendix D is a listing of the data card deck used to generate Fig. 1-7 through 1-9.

TABLE 2-3
ORDER AND NUMBER OF REQUIRED INPUT CARDS

Card No. from Table 2-2	Required No. of Cards	Card Description
1	1	Number of categories, N_c
2 . . 2	N_c	Category titles
3	1	Number of major activities, N_a
4	1	Major activity title
5	1	Number of subactivities, N_s
6	1	Subactivity title
7	1	Costs allocation card
8	1	Number of line-items N_i in this subactivity
9 10 11* . . . 9 10 11*	N_i Sets	Line item description and funding schedule
6 to 11	repeated N_s times	
4 to 11	repeated N_a times, including required subactivity cycles	

*Optional.

2.3.3 Additional Information

2.3.3.1 Program Limitation

The September 1968 version of this program will accept up to 27 categories. If a value over 27 is punched on card 1 the result will be a bad program run and probably an abort.

2.3.3.2 Error Messages, Aborts and Recovery

There are no programmed error messages or aborts. The only logical abort occurs if the data cards are mispunched or the data deck is improperly sequenced. These errors result in a normal FORTRAN syst . abort.

There are no recovery points built into the program. If errors do occur, the program and data should be completely re-run.

2.3.3.3 Equipment R ired and Running Time

The program requires a central processor, a card reader and an output printer. The program processes the input data essentially as fast as it is read and is therefore limited by the speed of the output. Since there are two pages of output per subactivity, a rough estimate of the running time, in seconds, is 6 times the total number of subactivities specified.

Section 3.3 presents additional details on the program, primarily for a maintenance programmer.

3.0 M/ TENANCE PROGRAMMER MANUAL

3.1 Integrated Buoy Deployment Cost Model*

3.1.1 Introduction

The purpose of the buoy deployment program is to compute the distance, time and cost required to deploy a given set of buoys from a port and depot. A great circle subroutine computes the distance between the given latitude-longitude points. The program computes the time required to travel this distance for the ship speeds that are specified. From these computed travel times, and other factors, various cost computations are made to determine the time and total deployment costs for each ship speed specified. A clock subroutine is used throughout to record the beginning and ending date for each cruise and the date each buoy is implanted. Another subroutine computes the individual and total system hardware cost for all the buoys deployed.

3.1.2 Verbal Flow

Figure 3-1 is a macro flow diagram of the deployment program and should be used in conjunction with the verbal flow that follows. For greater program details, the reader should refer to the program compilation listing in Appendix F and the micro flow diagrams in Appendix G. The program source deck is Appendix H.

Initial input data are read from the DEPLOY card through the COST card (see Table 2-1). The counters to be used in subroutine CLOCK are set to the starting time on the DEPLOY card. A search is made of the ship operating cost table to find the cost values corresponding to size of ship being used. All deployment counters and constants are set and an output page is printed containing the constants to be used.

BUOY and NAVP cards containing latitude-longitude locations are read and stored in the order in which they are read. A STOP card signals the end of these input cards which are then sorted into the deployment order specified on the ORDER cards. Subroutine SUBSNR is called to compute the number and cost of the subsurface sensors required and the cost of mooring for each buoy location. Total and average values are also computed for buoy hardware cost, length of mooring required, and subsurface sensors required. The data buoy hardware cost and deployment order page is printed upon return from SUBSNR.

---

*This computer program was coded, checked out, and maintained by Bernard J. Erickson.

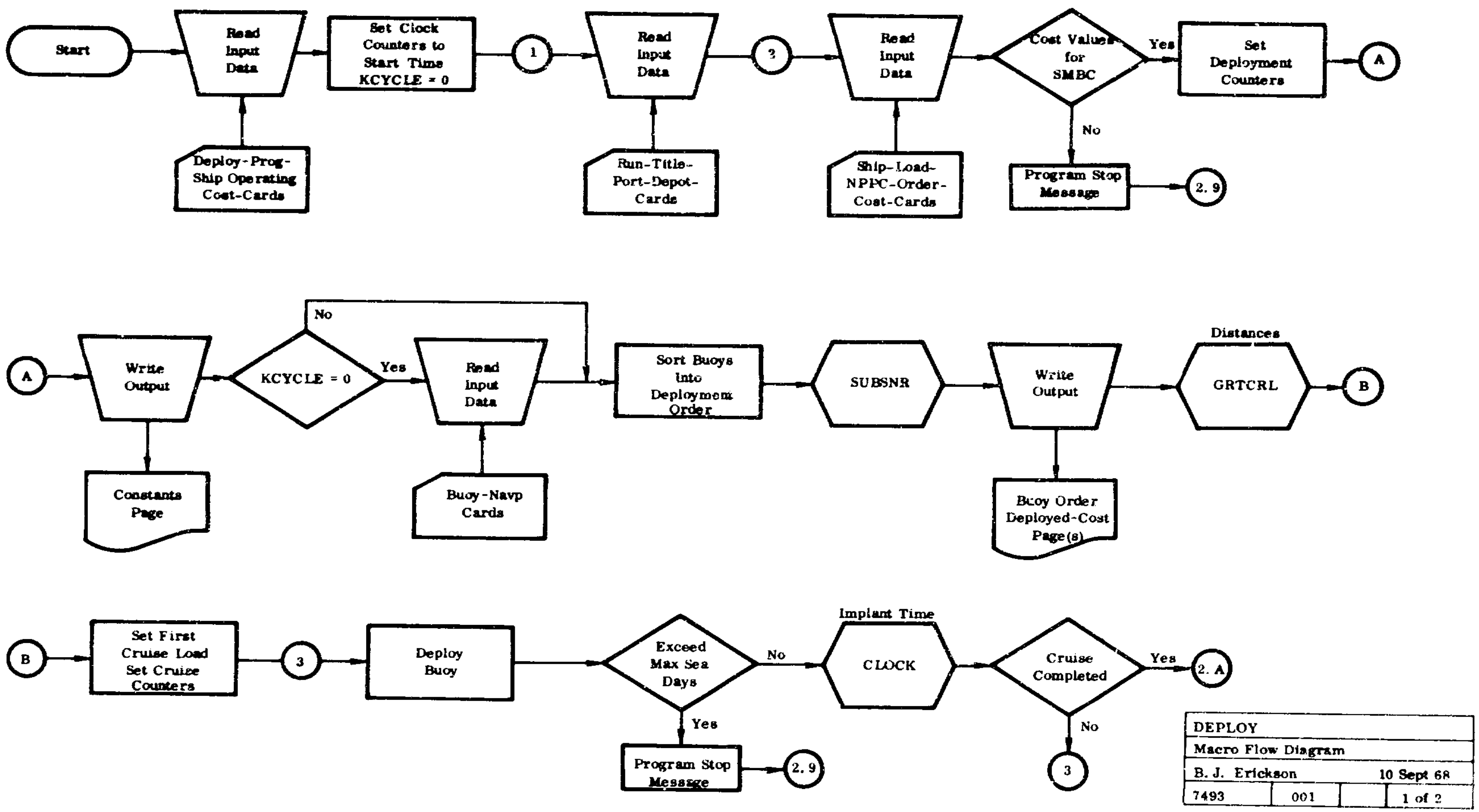


Fig. 3-1. Micro Flow Diagram of the Buoy Deployment Program (Sheet 1 of 2).

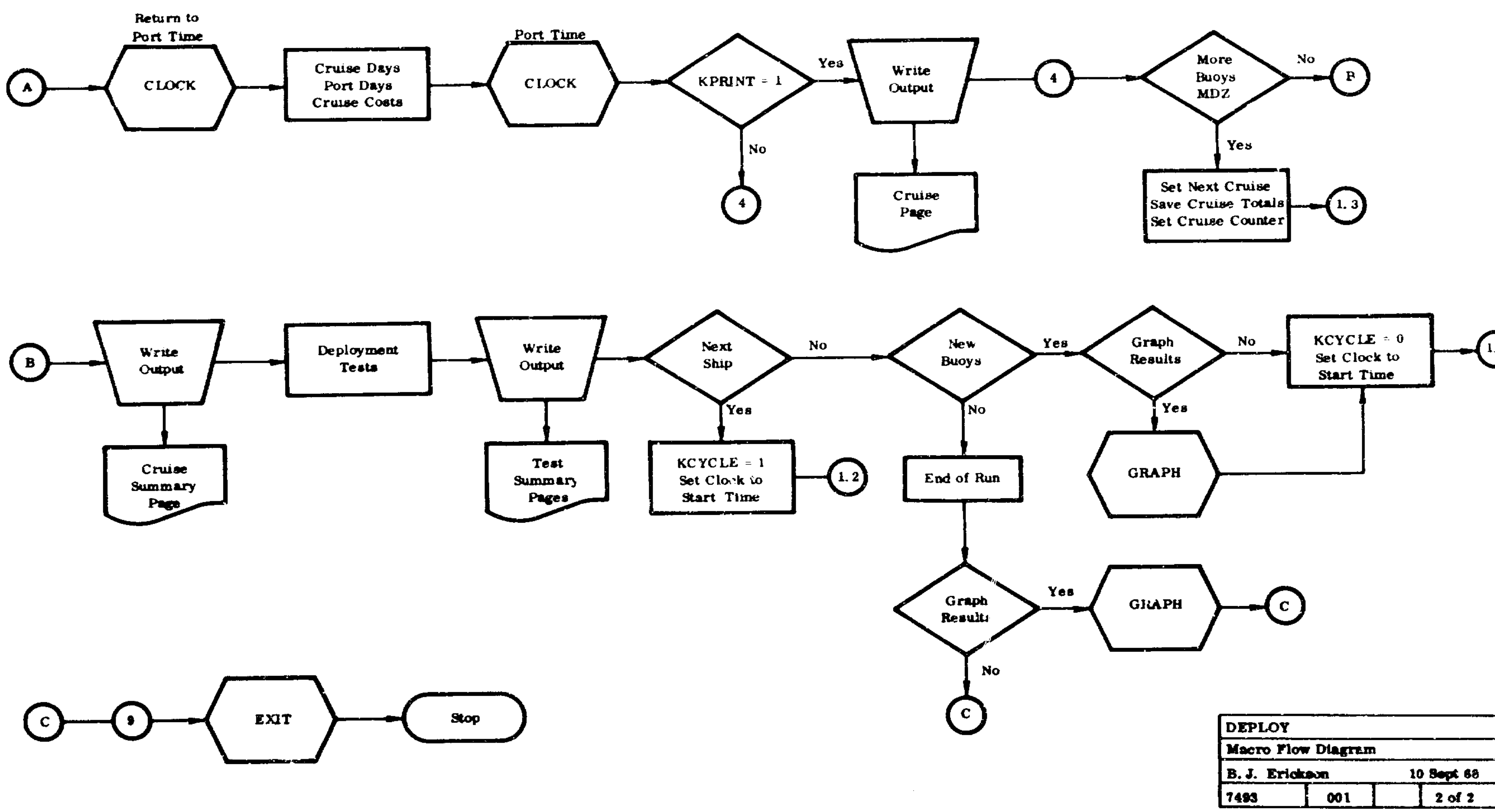


Fig. 3-1. Micro Flow Diagram of the Buoy Deployment Program (Sheet 2 of 2).

Subroutine GRTCRL is called once to compute all the required distances. A distance is computed from the port to each buoy location and the distance between successive buoy location in the order deployed. If the buoy depot and the port are not the same, the distance between the port and the depot and from the depot to the first buoy deployed on a cruise is also computed.

The first cruise load value is taken from the LOAD card and cruise counters are initialized. The time to deploy a buoy is the time to travel to the buoy location plus the time at the location to implant the buoy. A test is made to determine if the time to deploy the next buoy plus the time required for the ship to return to port exceeds the desired number of days at sea per cruise. If this value is exceeded, a message is printed out but the deployment continues. If the time to deploy the next buoy and return to port exceeds the maximum number of days at sea per cruise, a message is printed out to this effect and all further deployment is terminated. Subroutine CLOCK is called and given the time required to deploy the last buoy. If the cruise is not completed, the next buoy is deployed and the complete procedure is repeated.

When the last buoy for a cruise has been deployed, the ship returns to port and the date is recorded by CLOCK. The total cruise days, port days, and cruise costs are computed. The in-port time is recorded by CLOCK and a cruise summary is output, if that option has been set. If more buoys remain to be deployed, the next load of buoys is determined, completed cruise totals are saved, and the cruise counters set for the next cruise. Program control now goes back to the deployment procedure described in the previous paragraph.

When all buoys have been deployed, appropriate totals are computed. A Cruise System Deployment Summary Page is printed that describes the individual cruises and presents the total deployment cost computations. A series of calculations are made to process the eight different ship speeds for four different buoy implanting times and for three different base costs per sea-day. The results of these computations are printed on three Test Summary Pages, one for each base cost used.

An option card is read and checked to determine if the NEXT ship is to be used, NEW buoys are to be deployed or if the machine run is finished. If the NEXT ship option is to be exercised, necessary SHIP, LOAD, NPPC, and ORDER cards are read and the deployment procedures are repeated. If NEW buoys are to be input, a check is made to determine if previous results are to be graphed. If graph is requested, subroutine GRAPH is called and selected computations are presented in graphical form (for diagnostic purposes only). Upon completion of GRAPH, clock counters are set to the start time and the program returns to read a new set of cards, starting with the run card. All tests and deployment procedures are repeated for the new buoy data read.

When all input data have been processed, a check is made to determine if the last computed results are to be graphed. If graph is requested, subroutine GRAPH is called as before. Upon completion of GRAPH, subroutine EXIT is called and the machine run is terminated.

3.1.3 Deployment Subroutines

Subsurface Sensors (SUBSNR). The call to this subroutine contains location, depth, hardware unit costs and note of whether the location is for a BUOY or NAVP card. The output of SUBSNR to the main program is the number of subsurface sensor packages required per buoy, the total hardware cost for each buoy, the total number of subsurface sensors required and the total length of mooring needed for all buoys.

The number of subsurface sensors required is determined by comparing the buoy depth, in feet, with the depths listed in Table 3-1. A search is made through Table 3-1 for each buoy location depth, until the depth equals one of the levels or falls between two adjacent levels. If the depth equals a level exactly, the number of sensors required is equal to the level number given in Table 3-1. If the depth falls between two levels, the number of sensors is equal to the lower level number if the difference between the depth and the lower level is equal to or greater than 0.3 of the difference between the two adjacent levels. If the depth exceeds level 20, (16,405 ft) the number of subsurface sensors is set at 20.

The cost of subsurface sensors per location is the number required times the unit cost of a sensor. Cost of mooring is the location depth times the cost of mooring times the mooring scope. Total buoy hardware cost is basic buoy cost plus the cost of the sensors and the cost of the mooring. Total hardware cost for all buoys being deployed is the sum of the individual buoy costs.

If the latitude-longitude location is for a NAVP card, the above procedures are skipped and the next input location is tested until another BUOY card is found or the complete list of inputs has been tested.

TABLE 3-1
DEPTHS AT WHICH SUBSURFACE SENSORS ARE REQUIRED

Level no.	Depth ft	Level no.	Depth ft
1	0	11	1312
2	33	12	1641
3	66	13	1969
4	98	14	2625
5	164	15	3281
6	246	16	4922
7	328	17	6562
8	492	18	9843
9	656	19	13124
10	984	20	16405

Date-Time Clock (CLOCK). Subroutine CLOCK receives a time input from the main program which may be in hours, days or months. CLOCK maintains a 24-hour day counter, 30-day month counter, and a 12-month year counter. CLOCK is set with the initial starting deployment hour, day, month, year obtained from the DEPLOY card.

When the hour counter equals 24, hour = 0 and day = day + 1. When the day counter equals 31, day = 1 and month = month + 1. When the month counter equals 13, month = 1 and year = year + 1. A set of calendar month names are read in to convert the month value into JAN, FEB, etc. for printed output.

An option to accumulate total days is available in the CLOCK subroutine but is not used since total days are maintained in the main deployment.

Great Circle (GRTCRL). Subroutine GRTCRL calculates the great circle distance between points on the surface of the earth. These points are defined by their latitude and longitude given to the nearest tenth of a degree. Prior to calling GRTCRL, however, all south latitudes and west longitudes are converted to negative values for computational ease and consistency. Also, degrees and tenths are converted to radians before any computations are made.

The great circle distance between two locations is computed by:

$$\cos a = (\sin b \times \sin c) + (\cos b \times \cos c \times \cos A) \qquad (3\text{-}1)$$

where a is the resulting great circle arc, b and c are the latitudes of the two input locations and A is the absolute value of the smallest difference in longitude between the two points. The arctangent function is used to convert (cos a) into an angle in radians by:

$$\text{angle} = \tan^{-1}\left([1 - (\cos a)^2] / \cos a \right) \qquad (3\text{-}2)$$

The angle is converted from radians to degrees and multiplied by 60.11031 to obtain distance in International Nautical Miles. The output of GRTCRL is an array of port-to-buoy and buoy-to-buoy distances for all points of interest.

GRAPH Diagnostic Subroutine. This subroutine was incorporated into the deployment program to aid in checking for input errors. The subroutine was never fully checked out and it is not to be used for production runs, although the call to GRAPH and a dummy subroutine are part of the final program. This paragraph is to inform the maintenance programmer of this subroutine's existence in the program, however, development or use of this subroutine must be the complete responsibility of the maintenance programmer.

3.1.4 Input Card Format Statements

Table 3-2 is a list of the FORTRAN format statements that are used to read in the various data cards for the deployment program. A careful check of these formats with the punching instructions given in Section 2.1.1 will show there are additional items read from the run card that are not included in the card or program description. These additional inputs were used during program development to produce summary results that could be input to subroutine GRAPH. This feature was considered to be only a developmental function and was not intended for routine use. However, it was not removed from the program and could be refined by a maintenance programmer if there is a need for such summary output.

TABLE 3-2
DEPLOYMENT INPUT CARDS FORTRAN FORMAT STATEMENTS

Card Name	Format Statement
DEPLOY	16X, I2, A4, I3, 4X, I2, 23X, 4I3
Alpha	12A4, 2X, 5A1, 2X, 4A4
SPCST	8[5X, F5.1, 5 (F3.0, F5.0, F6.2)]
Run	2I3, A4, I3, 7X, 2I3, 9F5.1, 1X, 8I1
Heading	2 (20A4)
PORT	6X, I3, 5X, 3A4, F6.1, A1, F6.1, A1, 3F3.0
DEPOT	6X, I3, 5X, 3A4, F6.1, A1, F6.1, A1
SHIP	8X, 3A4, I3, 8X, 4F3.0, 3F5.2, 3F6.0
COST	6X, F6.0, 2X, F5.0, 2X, F5.0 2X, F5.2
BUCY NAVP	A4, 1X, A4, 11X, F6.1, A1, F6.1, A1, I6, A1 F7.0
LOAD (1) (2)	4X, 25I3 26I3
NPPC (1) (2)	4X, 25I3 4X, 25I3
STOP	A4
ORDER	5X, 25I3
NEXT	A4
NEW	A4
THE END	A4

3.2 Procurement, Maintenance, Replacement-Cost Model Computer Program*

3.2.1 Program Flow

The logic for this program is shown in Fig. 3-2 and in the compilation listing presented as Appendix I. After the identification and control cards have been read, the program builds an array of the input component (item) cards. When all of these have been read, the costs and numbers are computed for Eqs.(2-2) to (2-5). Results are output, the option card is read and control goes to the appropriate part of program. If the item cards are to be changed, the previously stored array is modified according to the new input cards. When all changes have been made, the new values are computed and the next option card is read.

There are no subroutines in this program.

The source deck for this program is presented as Appendix J.

3.2.2 Format Statements

The FORTRAN statements used to read each input card is shown in Table 3-3. The card numbers in Table 3-3 are the same as those used in Section 2.2.2. It may be noted that any set of input control characters may be input as long as they are also used on the option cards. A match for card se, THE END card, is not input; the end is assumed if the control characters do not match with any of the three input words on card 1.

3.3 TDP 10-year Financial Plan Program**

3.3.1 Program Description

This program accepts a card deck describing line items and their funding schedule from a TDP. Input card information is cyclical and can be easily changed in response to different TDP strategies.

The flow diagram for this program is shown in Fig. 3-3. A compilation listing is presented as Appendix K and the program source cards as Appendix L.

After the category title cards have been stored, the program reads and processes the data cards in cycles. The required number of inputs within a processing cycle is read from a data card preceding the cycle of data. One card tells how many major

---

* This program was coded and developed by Bernard J. Erickson.

** This program was coded and maintained by Edward R. Sweeton.

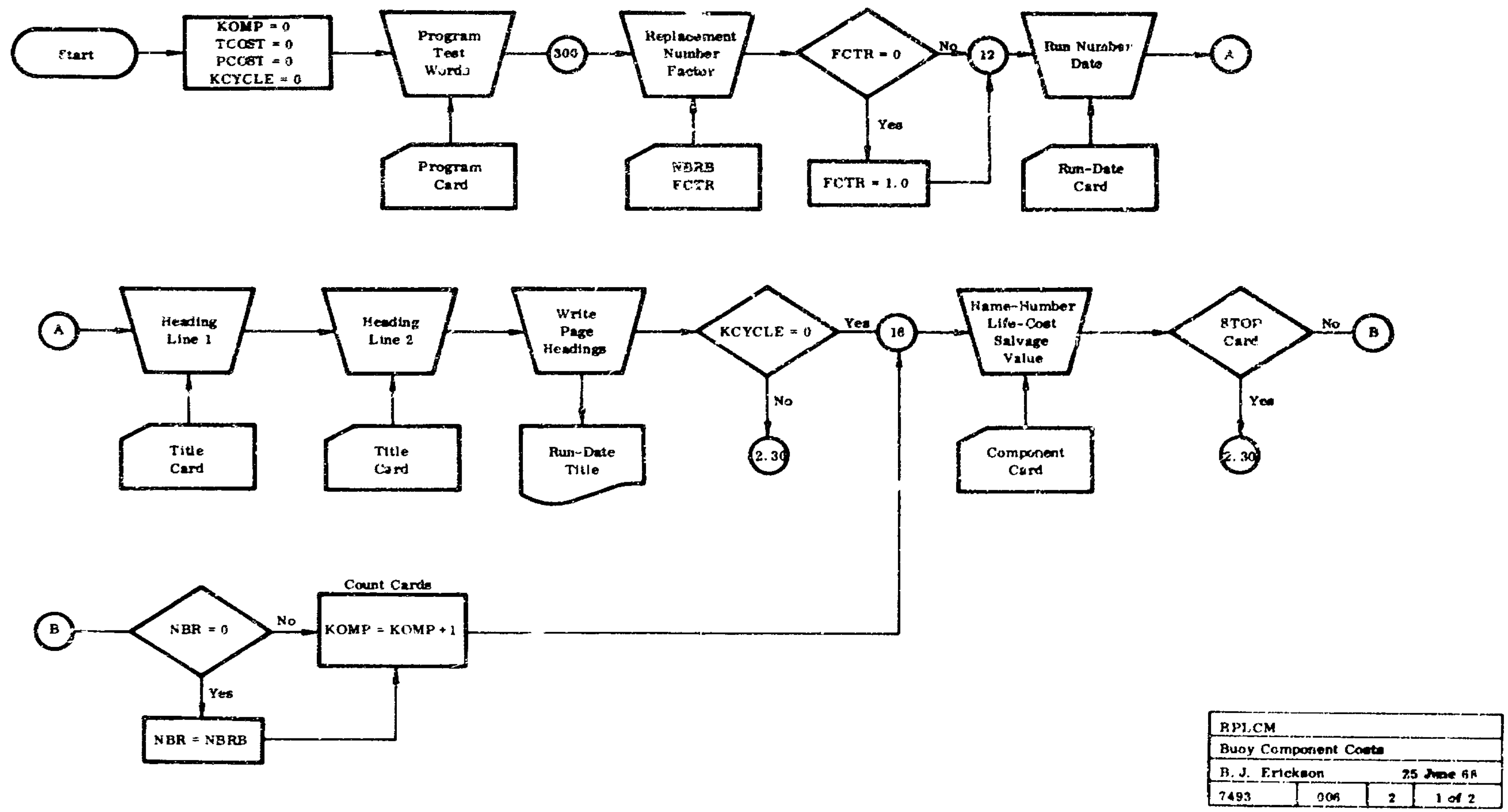
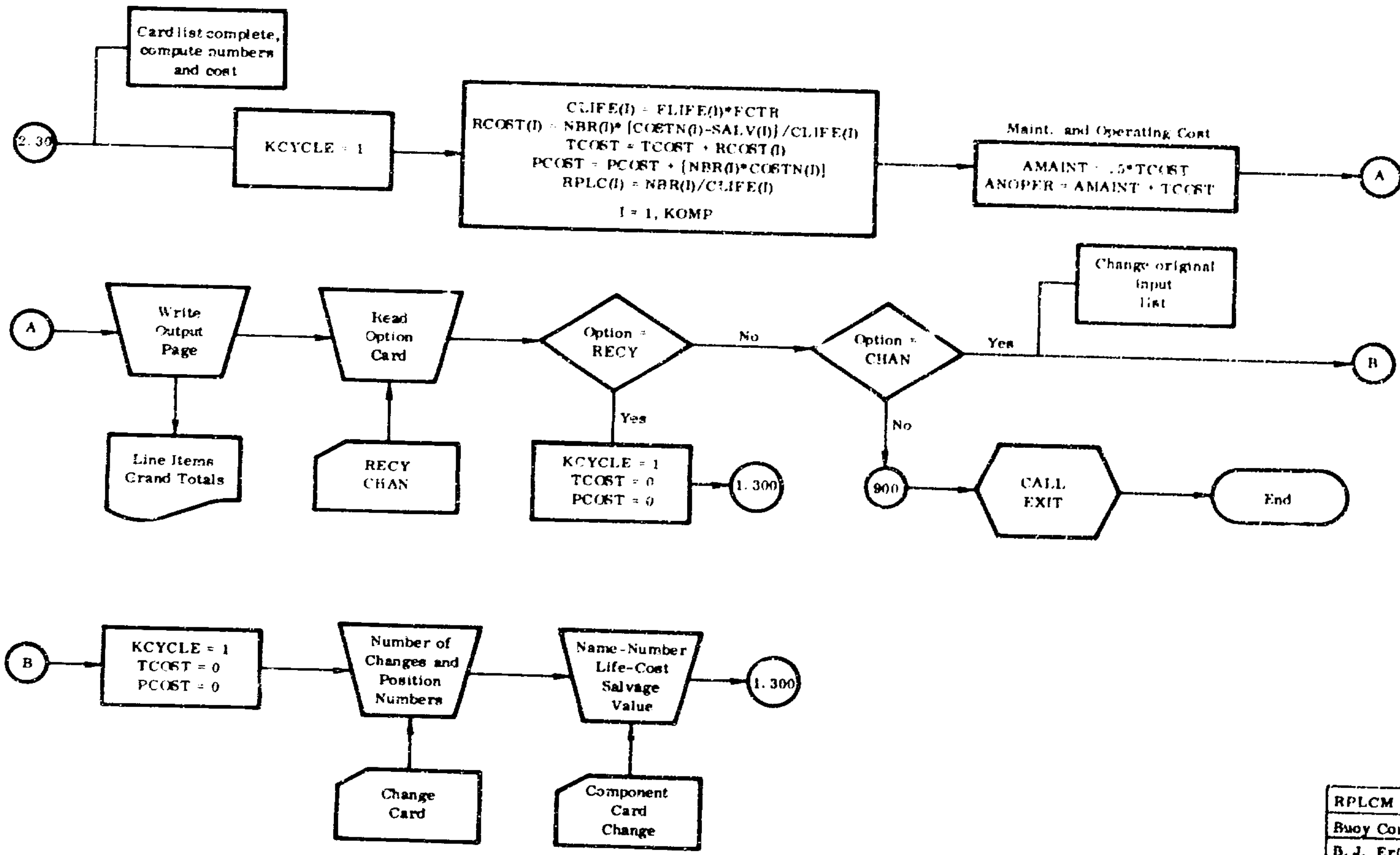


Fig. 3-2. Flow Diagram for the Procurement, Maintenance and Replacement Program (Sheet 1 of 2).



RPLCM			
Buoy Component Costs			
B. J. Erickson		25 June 68	
7493	006	2	2 of 2

Fig. 3-2. Flow Diagram for the Procurement, Maintenance and Replacement Program (Sheet 2 of 2).

TABLE 3-3
FORTRAN INPUT FORMAT STATEMENTS FOR THE
PROCUREMENT, MAINTENANCE, REPLACEMENT-COST PROGRAM

Card	Format Statement
1	3A4
2	13X, 13, 26X, F3.1
3	5A4
4 and 5	16A4
6	4A4, 4X, F4.0, F5.0, 2X, F8.0, 2X, F6.0
7	A4
8a	A4
8b	A4
8c	A4
9	I2, 26I3/24I3

activity cycles there are. Another input gives the number of line items within a sub-activity. Thus, it is easy to see how the program sets up the necessary loops to read in all the input data.

The FORTRAN format statements used to read the various card inputs are presented in Table 3-4.

Subroutine CMPBAR is a machine language subroutine used to prepare a bar graph for the funds for each quarter or for the year. The main program determines the appropriate scale to show most clearly the totals in the space allowed. The subroutine processes the data for the four quarters per subroutine entry. The calling sequence arguments to the subroutine are IQTR, NSCL and BAR. IQTR is the array of four quarterly totals and NSCL is the necessary scaling information. The subroutine determines the number of characters and blanks to represent the total for each quarter and prepares an appropriate entry in the return data array BAR. The subroutine exits when the array BAR is completed; this array, as a bar graph, is subsequently written with the other information for the quarter with an A format statement.

The FORTRAN read input card format statements are listed in Table 3-4.

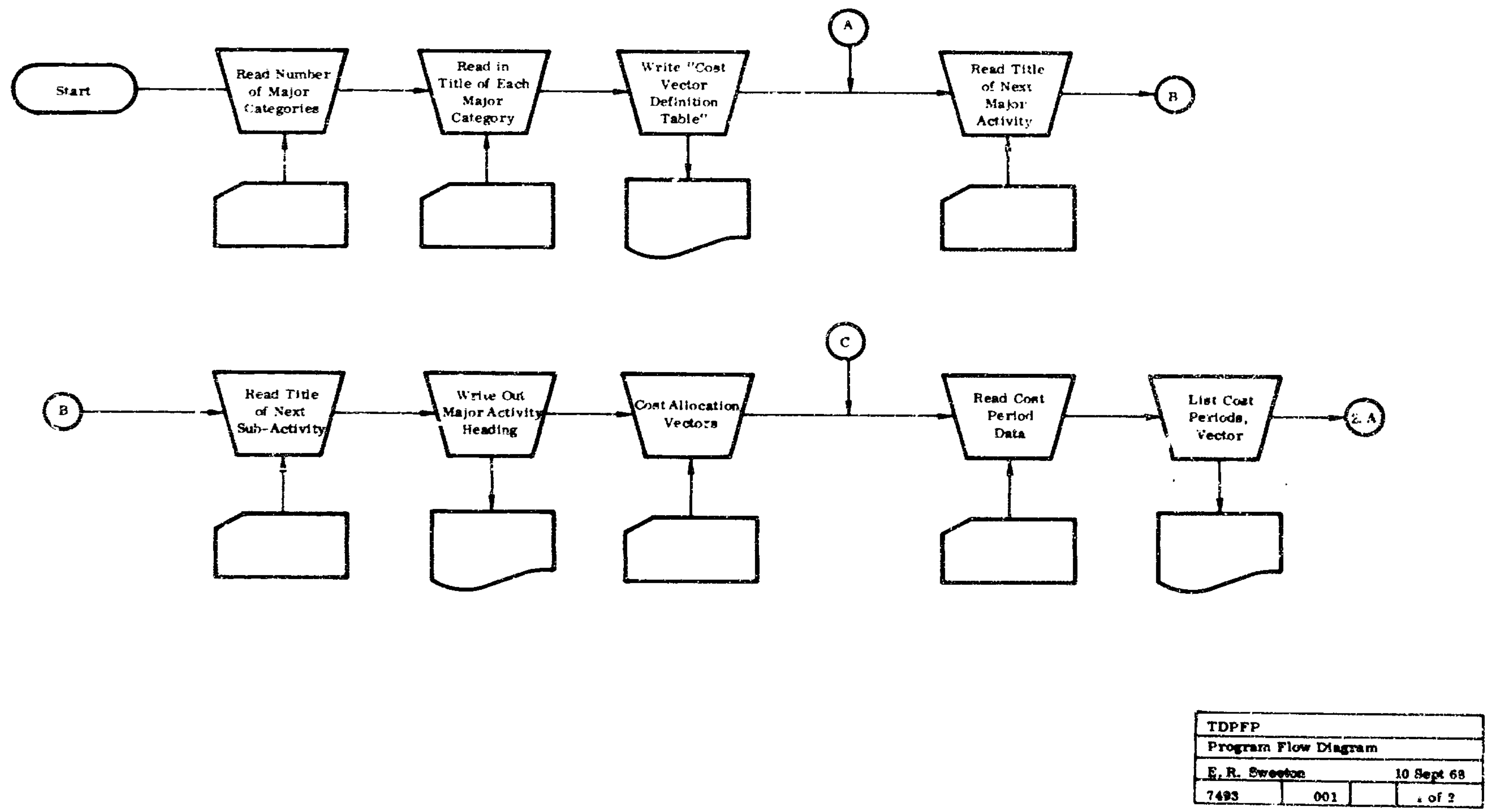
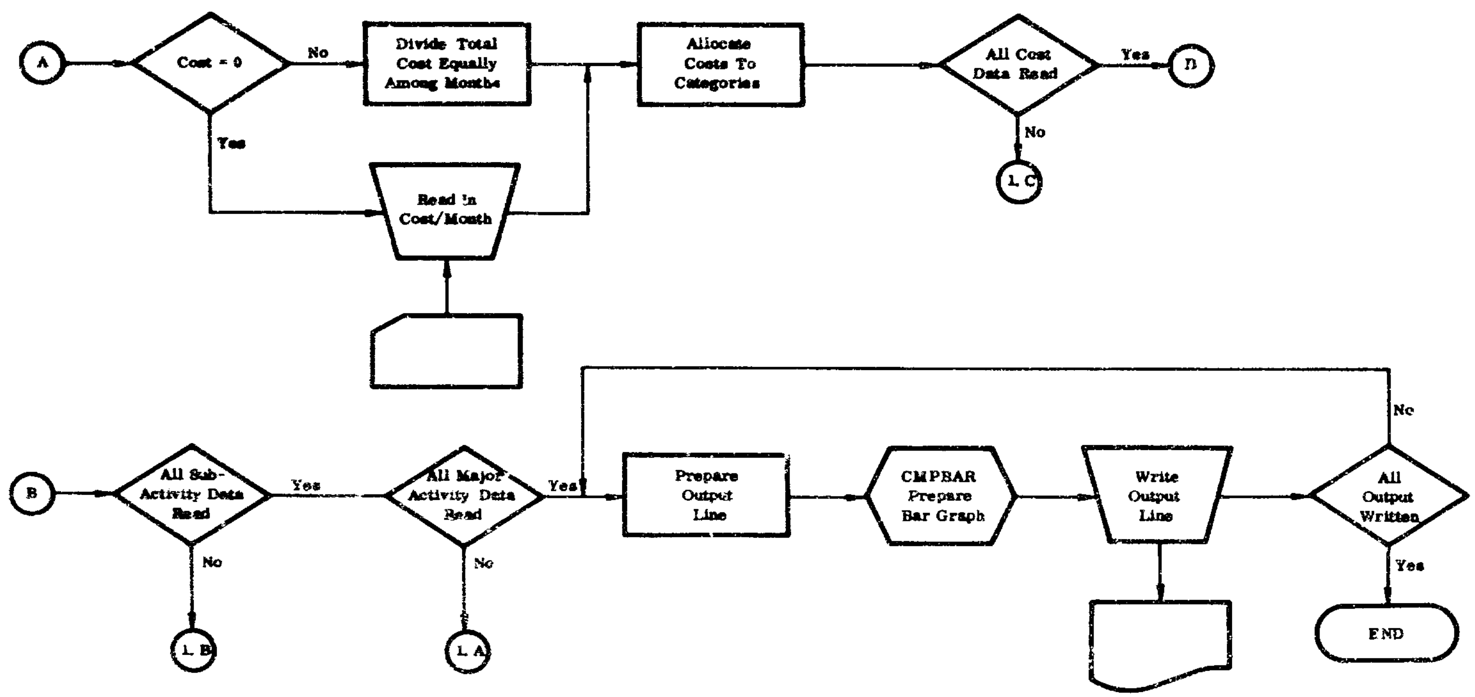


Fig. 3-3. Flow Diagram for the 10-Year TDP Financial Plan Program (Sheet 1 of 2).



TDPFP			
Program Flow Diagram			
E. R. Swetton			10 Sept 68
7493	003		2 of 2

Fig. 3-3. Flow Diagram for the 10-Year TDP Financial Plan Program (Sheet 2 of 2).

TABLE 3-4
FORTRAN INPUT FORMAT STATEMENTS FOR THE
TDP 10-YEAR FINANCIAL PLAN PROGRAM

Card	Format Statement
1	2I5
2	20A4
3	I5
4	20A4
5	I5
6	20A4
7	40I2
8	I5
9	10A4
10	2I5, F12.0
11 11a 11b etc.	6F12.0

3.3.2 Possible Program Modifications

The program is set to assign input month 1 the output date of month 1, 1969. This date occurs because item NR in the program is set to 1968. Should a different or variable date be needed for output, the programmer can change the value of NR or make it an input item if desired.

To allow the program to accept over 27 input categories it would be necessary to change the 27 in the DIMENSION statements to the desired new value.

3.4 The Buoy Components Characteristics Data File

3.4.1 Data Card Deck

The data collected on buoy components have been formatted and punched onto cards and these cards read onto magnetic tape. The components defined, the number used to identify the component on the cards and tape, and the number of entries for each component are listed in Table 3-5. For all of these components, there are

TABLE 3-5
BUOY COMPONENT NUMBERS

Component number	Entries	Component name
01	37	Hull, surface
02	22	Hull, subsurface
03	43	Mooring, main
04	46	Power systems, battery
05	28	Telemetry
06	15	Interrogation
07	33	Data storage
08	25	Sensor scanner
09	16	Data processor
10	27	Current velocity sensor
11	24	Wind velocity sensor
12	20	Air temperature sensor
13	36	Water temperature sensor
14	4	Acoustic transponder
15	2	Mooring depth control equipment
16	14	Acoustic release sensor
17	15	Atmospheric pressure sensor
18	3	Solar radiation sensor
19	1	Precipitation sensor
20	2	Dew point sensor
21	7	Salinity/conductivity sensor
22	2	Magnetic sensor
23	18	Depth sensor
24	0	Azimuth sensor
25	3	Acoustic sensor
26	1	Vibration sensor
27	5	Pitch and roll sensor
28	4	Acceleration sensor
29	6	Tensiometer sensor
30	41	Time control equipment
31	43	Mooring, tether
32	46	Power systems, other

84 characteristics of possible interest to the user and six card fields used to further describe the card and tape data. Obviously, only a few of the 84 user-oriented characteristics apply to each component; however, only three are common to all components. A pseudo 32 x 90 matrix is maintained in which to place those data that are available.

The punched card deck requires six consecutive cards to define all of the 90 possible characteristics and data identification card fields. Table 3-6 presents the card and column used for each of these fields. The complete data card deck of component and characteristics is presented as Appendix M.

3.4.2 Card-to-Tape Program

A card-image magnetic tape of the component data was prepared that could be used as the starting point for further development of a data file and the processing of such data. Since all components require less than the six full cards to describe their characteristics, the data on tape is one or two records per item. Record one is the data on cards 1 to 3; a second record was written if there are any data for the component on cards 4, 5 or 6. Thus, the number of cards per component (card 1, column 14) also is the indicator for the number of consecutive records on tape to describe the component as follows:

Column 14	No. of Records on Tape
1 to 3	1
4 to 6	2

The flow diagram for the program to write the card data on tape is presented as Fig. 3-4. A compilation listing of this program is Appendix N and the program source cards are Appendix O. The only input control to this program is a card at the end of the component data deck to signal the end of data. This card has the format

Columns	Contents
10-13	9999
14	0

and is written as the last 3-card record on the data tape.

TABLE 3-6
BUOY COMPONENT CHARACTERISTIC DATA FIELDS

	Columns	Data
Card 1	1-2*	Component number
	3	blank
	4-5	Item number within the component
	6-9	Buoy identification number
	10-13*	Year and month item entered into the data file
	14*	Number of punched cards required to include all characteristics pertinent to the component
	15-20	blank
	21-24	Manufacturer, left adjusted
	25-36	Model number
	37-40	Cost, dollars
	45-48	Reliability
	49-58	Type, left adjusted
	59-63	Range, low
	64-71	Range, high
	72-78	Accuracy
	79-80	blank
Card 2	1-10	Output characteristics, left adjusted
	11-21	Size
	22-28	Weight
	29-34	Diameter
	35-40	Length
	41-44	Height
	45-48	Width
	49-58	Depth Limits
	59-62	Survivability
	63-66	Construction, left adjusted

*Data processed as an I data field, all others are processed as A data fields.

TABLE 3-6 (Continued)

	Columns	Data
Card 2 (Cont.)	67-70	Material
	71-80	Capacity
Card 3	1-10	Code type, left adjusted
	11-16	Accuracy, speed
	17-20	Accuracy, direction
	21-26	Type, speed
	27-32	Type, direction, left adjusted
	33-42	Output, speed, left adjusted
	43-52	Output, direction, left adjusted
	53-58	Power requirements
	59-62	Biological immunity
	63-69	Breaking strength
	70-73	Buoyancy material, left adjusted
	74-77	Carrier frequency, left adjusted
	78-80	Direction reference, left adjusted
Card 4	1-7	Displacement
	8-11	Electrical integrity
	12-17	Frequency
	18-22	Lateral displacement
	22-25	Medium, left adjusted
	26-29	Resistance to corrosion, left adjusted
	30-32	Corrosion protection below, left adjusted
	33-35	Stretch to break
	36-43	Time Constant
	44-48	Scope
	49-55	Buoyancy
	56-58	Corrosion protection above
	59-63	Power output
	64-66	Anchor release (yes-no), left adjusted

TABLE 3-6 (Continued)

	Columns	Data
Card 4 (Cont.)	67-70	Anthor type, left adjusted
	71-75	Anchor weight, pounds
	76-80	Anchor cost, dollars
Card 5	1-4	Anchor chain
	5-7	Antenna
	8-11	Average time, speed
	12-15	Average time, direction
	16-18	Auxiliary floats
	19-23	Ballast material, left adjusted
	24-30	Ballast weight
	31-33	Modulation type, left adjusted
	34-39	Band width
	40-44	Capacity A/H
	45-51	Charging system, left adjusted
	52-55	Efficiency
	56-63	Data rate
	64-67	Draft
	68-73	Fuel, left adjusted
	74-77	Interrogation security
	78-80	Mast height
Card 6	1-3	Mast diameter
	4-6	Mooring depth control
	7-9	Redundancy, left adjusted
	10-13	Storage code, left adjusted
	14-21	Storage type, left adjusted
	22-26	Reel capacity
	27-34	Sampling rate
	35-42	Scan rate
	43-45	Static stability angle

TABLE 3-6 (Continued)

	Columns	Data
Card 6 (Cont.)	46-48	Swivels, left adjusted
	49-54	Total mooring cost
	55-59	Transient interval
	60-64	Transient duration
	65-74	Power
	75-80	Function

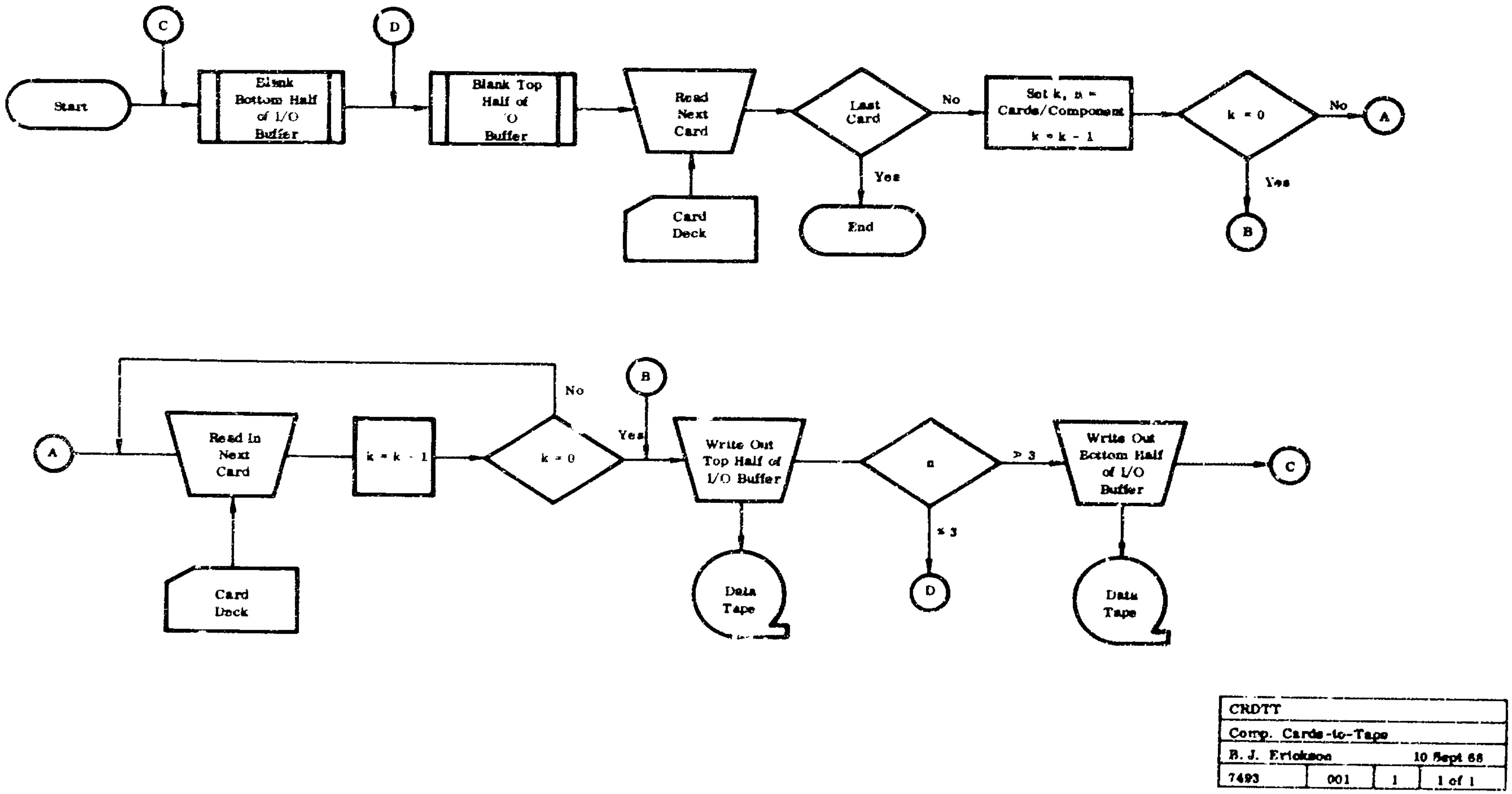


Fig. 3-4. Flow Diagram of the Data File Card-to-Tape Program.

The read and write format statements for the card data can be determined from Table 3-5. Fields read and written as integers are indicated by an asterisk, all other fields are treated as alphanumerics.

3.4.3 Data File Retrieval

When the buoy component data described in the previous section are to be used for further automatic data processing, it will be desirable to have a data file retrieval program. This program would be able to extract from the data file exactly those components, or group of components, and their characteristics that are required for further processing. Since the additional ADP work with these data could not be adequately outlined at this time, it was not desirable to develop such a retrieval program. However, in order to verify the results of the card-to-tape process, and to document the contents of the tape data file, a simple retrieval program was prepared. This program operates as shown in the flow diagram in Fig. 3-5. The compilation listing for this program is presented in Appendix P and the source cards as Appendix Q. The results of running this program against the data file are presented in Appendix A.

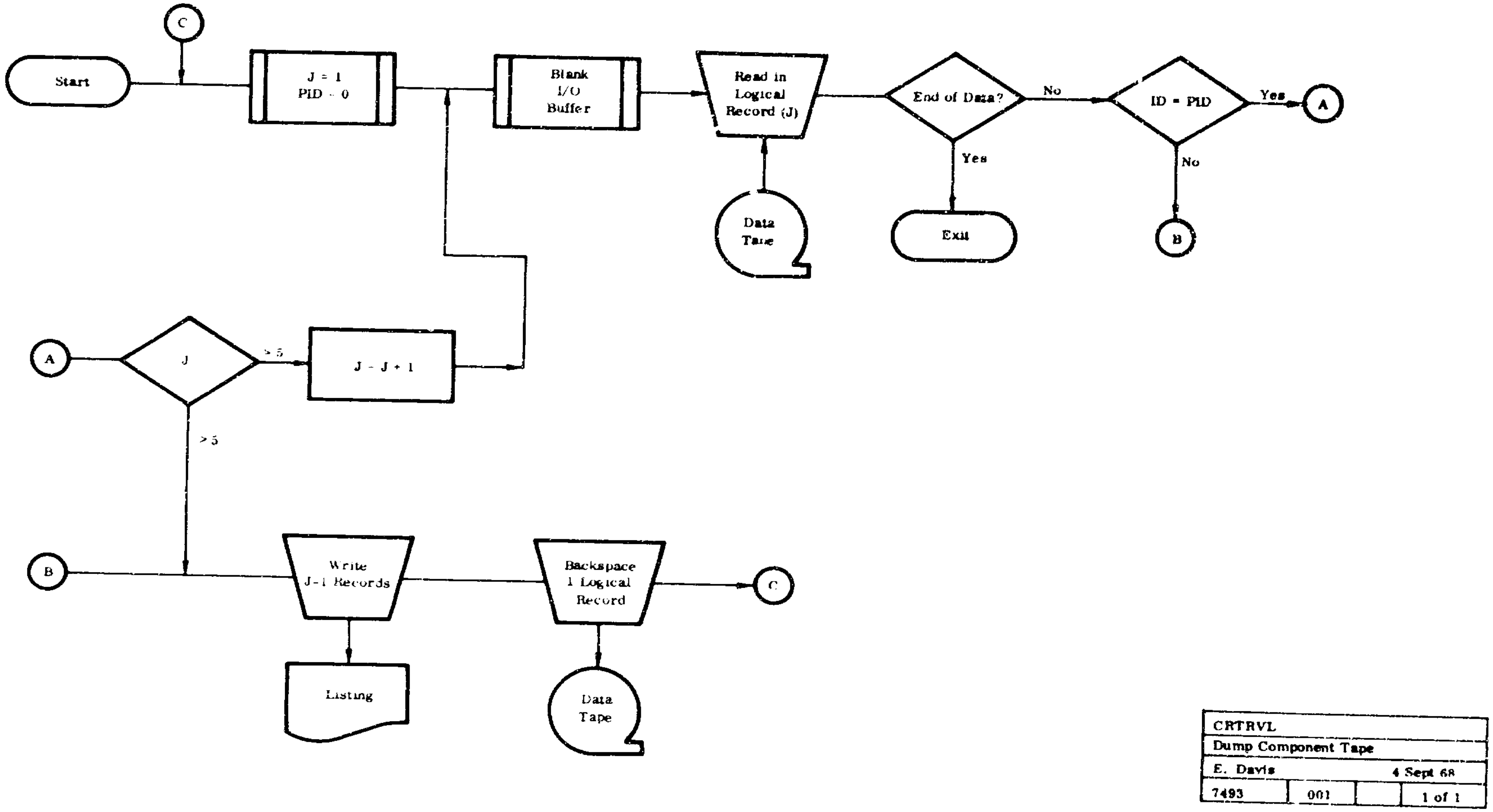


Fig. 3-5. Flow Diagram of the Data File Retrieval Print Program.

APPENDIX A

LISTING OF

THE BUOY COMPONENT DATA FILE TAPE

(Limited distribution of this Appendix is under separate cover)

APPENDIX B

REFORMATTED LISTING OF

THE FNWC DEPTH DATA

(Limited distribution of this Appendix is under separate cover)

APPENDIX C

BUOY DEPLOYMENT MODEL SAMPLE INPUT DATA DECK

```
                                        CARD COLUMNS
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

// EXEC
DEPLOY STARTING  1 JAN 69 AT 0800 HOURS.IMPLANT INCR =  0 12  6  6
 JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC  NEWSM  STOPNEXTNEW NAVP
COST    9.0  4  246  2.19  6  306  2.75  8  445  2.75 10  600  5.78 12  600  5.78
COST   12.0  4  246  2.19  6  306  2.75  8  445  2.75 10  600  5.78 12  600  5.78
COST   15.0  4  246  2.27  6  306  3.68  8  445  3.68 10  600  5.78 12  600  5.78
COST   18.0  4  306  4.38  6  306  4.38  8  600  7.01 10  600  7.01 12  600  7.01
COST   21.0  4  515  7.51  6  780 11.27  8  780 11.27 10  780 11.27 12  780 11.27
COST   24.0  4  980 16.43  6  980 16.43  8  980 16.43 10  980 16.43 12  980 16.43
COST   27.0  4 1200 23.37  6 1200 23.37  8 1200 23.37 10 1200 23.37 12 1200 23.37
COST   30.0  4 1400 30.00  6 1400 30.00  8 1400 30.00 10 1400 30.00 12 1400 30.00
110  4 OCT 68
WEST PACIFIC MD7 FOR THE 375 TOTAL BUOY LOCATIONS MAP
INCLUDES NEW SHIP SEA-DAY AND PORT-DAY COST COMPUTATIONS
PORT    16      HONOLULU, HA  21.3N 157.8W
DEPOT   16      HONOLULU, HA  21.3N 157.8W
SHIP                     1          12
LOAD 10  8 12 12
MOPC      2
ORDER 37 36 31 30 03 06 33 34 35 44 08 05 45 04 45 07 11 28 17 39 38 18 16 10 09
ORDER 13 14 15 24 26 32 40 25 29 23 22 21 19 20 12 02 01 27 41
COST
BUOY WP 1  375 BUOY    00.1N 165.5E 16404
BUOY WP 2  375 BUOY    00.1N 154.8E  8202
BUOY WP 3  375 BUOY    50.0N 166.0E 18045
BUOY WP 4  375 BUOY    40.0N 139.0E  3280
BUOY WP 5  375 BUOY    40.0N 153.5E 14700
BUOY WP 6  375 BUOY    41.5N 167.0E 19685
BUOY WP 7  375 BUOY    33.0N 143.2E 22966
BUOY WP 8  375 BUOY    36.7N 158.8E 12000
BUOY WP 9  375 BUOY    30.0N 126.4E   656
BUOY WP10  375 BUOY    27.0N 135.0E 14764
BUOY WP11  375 BUOY    30.0N 155.5E 19029
BUOY WP12  375 BUOY    00.1N 144.2E 13123
BUOY WP13  375 BUOY    20.0N 116.0E  3280
BUOY WP14  375 BUOY    20.0N 126.7E 16404
BUOY WP15  375 BUOY    20.0N 137.0E 16404
BUOY WP16  375 BUOY    23.0N 146.0E 19685
BUOY WP17  375 BUOY    23.0N 171.0E 19200
BUOY WP18  375 BUOY    20.0N 158.8E 19685
BUOY WP19  375 BUOY    00.1N 123.2E  1312
BUOY WP20  375 BUOY    00.1N 134.0E 14108
BUOY WP21  375 BUOY    10.0N 116.5E   492
BUOY WP22  375 BUOY    10.0N 127.0E 22966
BUOY WP23  375 BUOY    10.0N 137.7E 16404
BUOY WP24  375 BUOY    14.0N 153.0E 19685
BUOY WP25  375 BUOY    10.0N 158.3E 18045
BUOY WP26  375 BUOY    15.0N 170.0E 16200
BUOY WP27  375 BUOY    00.1N 176.0E 13800
BUOY WP28  375 BUOY    25.0N 165.0E 19685
BUOY WP29  375 BUOY    11.0N 145.0E 15000
BUOY EP 1  375 BUOY    50.0N 180.0W  6561
BUOY EP 2  375 BUOY    50.0N 180.0W 21000
BUOY EP12  375 BUOY    10.0N 179.0E 14764
BUOY EP 4  375 BUOY    40.0N 180.0W 18045
BUOY EP 8  375 BUOY    32.4N 177.5E 16404
```

```
                                              CARD COLUMNS
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

BUOY EP 9  375 BUOY   30.0N 169.6W 16800
BUOY EP 5  375 BUOY   40.0N 165.0W 18045
BUOY EP10  375 BUOY   30.0N 161.2W 18045
BUOY EP13  375 BUOY   20.0N 180.0W 14764
BUOY EP14  375 BUOY   20.0N 16[illegible].5W 16404
BUOY EP19  375 BUOY   10.0N 170.8W 16404
BUOY EP28  375 BUOY   00.1N 173.7W 16404
BUOY EP20  375 BUOY   10.0N 160.4W 16404
BUOY EP15  375 BUOY   17.0N 160.5W 16404
BUOY EP33  375 BUOY   24.0N 164.0W 14764
NAVP NV45             41.5N 143.0E
STOP BUOY CARDS
END OF TEST RUN DATA
/*
```

APPENDIX D

PROCUREMENT, MAINTENANCE AND REPLACEMENT-

COST MODEL SAMPLE INPUT DATA DECK

```
                                    CARD COLUMNS
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

// EXEC
STOPRECYCOMP
REPLACEMENTS    1 BUOY   LIFETIME FACTOR = 1.0
RUN 1  20 JUN 68
TEST WITH LIFETIME FACTORS FROM 0.70 TO 1.30
DATA FROM DWN 51    DEPTH = 5000 M
40' DISCUS HULL             20      80000
MOORING/100 FT        165    1        175
40' POWER SYSTEM             5      10000
DATA STORAGE                 3      10000
DATA PROC.-SCAN.             4      15000
TIME CONTROL                 5       1000
BUOY TELEMETRY               5      15000
S/S SENSOR PKG         20    3       7000
AMBIENT NOISE           2    3       1000
AMBIENT LIGHT           2    3       1700
TRANSPARENCY SEN        2    3       1100
WAVE SENSOR                  5       6250
ATMOS PRESS SNSR             5        500
AIR TEMP SENSOR              5        400
DEW POINT SENSOR             3       1300
WIND VELCTY SNSR             2        600
PRECIP RATE SNSR             5        500
INSOLATION SENSR             5        500
ATMOS ELEC SNSR              5       1000
FUEL SUPPLY                  5        200
MOORING TENSION              3        500
HULL TEMP                    5        100
BILGE WATER LVL              5         50
MAG HEADING                  5        300
ANCHOR RELEASE               3       2500
ANCHR.CHAIN. ETC             1       1000
NAV RADIO BEACON             5       5000
NAV LIGHT/HORN               5        500
STOP COMPONENT CARDS
RECYCLE NEW LIFETIME FCTR
REPLACEMENTS    1 BUOY   LIFETIME FACTOR = 0.7
RUN 2  20 JUN 68
LIFETIME FACTOR DECREASED 30 PCNT
DATA FROM DWN 51    DEPTH = 5000 M
RECYCLE NEW LIFETIME FCTR
REPLACEMENTS    1 BUOY   LIFETIME FACTOR = 1.3
RUN 3  20 JUN 68
LIFETIME FACTOR INCREASED 30 PCNT
DATA FROM DWN 51    DEPTH = 5000 M
COMPONENT CHANGES FOR S/S. MOORING RECYCLE
 2  2  8
MOORING/100 FT         20     1       175
S/S SENSOR PKG         13     6      7000
REPLACEMENTS    1 BUOY   LIFETIME FACTOR = 1.0
RUN 4  20 JUN 68
TEST WITH LIFETIME FACTOR = 1.0 AND COMPONENT COST CHANGES
DATA FROM DWN 51    DEPTH = 5000 M
RECYCLE NEW LIFETIME FCTR
REPLACEMENTS    1 BUOY   LIFETIME FACTOR = 0.7
RUN 5  20 JUN 68
```

CARD COLUMNS

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

LIFETIME FACTOR DECREASED 30 PCNT
DATA FROM DWN 51     DEPTH = 5000 M
RECYCLE NEW LIFETIME FCTR
REPLACEMENTS    1 BUOY   LIFETIME FACTOR = 1.3
RUN 6  20 JUN 68
LIFETIME FACTOR INCREASED 30 PCNT
DATA FROM DWN 51     DEPTH = 5000 M
THE END
/*
```

APPENDIX E

10-YEAR TDP FINANCIAL PLAN PROGRAM

SAMPLE INPUT DATA DECK

```
                                          CARD COLUMNS
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

// EXEC
   26     1
                                             TOTAL COST
                                        TOTAL MANAGEMENT COST
                                            PROJ MAN OFFICE
                                            CONSULTANTS
                                            TRAINING
                                            COORDINATION
                                        TOTAL RESEARCH COST
                                            SENSORS
                                            MAT AND COMPONENTS
                                            GT LAKES AND ESTUARINE REQ
                                            COOPERATIVE EFFORTS
                                        TOTAL COST MK0
                                            SENSORS (MK0)
                                            HULL AND MOORINGS (MK0)
                                            SEABORNE SUPPORT (MK0)
                                        TOTAL COST MK1
                                            SENSORS (MK1)
                                            HULL AND MOORINGS (MK1)
                                            SEABORNE SUPPORT (MK1)
                                            SHORE SUPPORT (MK1)
                                        TOTAL COST MK2
                                            SENSORS (MK2)
                                            HULL AND MOORINGS (MK2)
                                        TOTAL COST MK0 AND MK1
                                        TOTAL COST SEABORNE SUPPORT
                                        TOTAL COST SHORE SUPPORT
    5
MANAGEMENT
    4
PROJECT MANAGEMENT
 1 1 1
    6
69- 1M PROJ MAN OFFICE
    1   12       400000
70- 1M PROJ MAN OFFICE
   13   24       670000
71- 1M PROJ MAN OFFICE
   25   36       780000
72- 1M PROJ MAN OFFICE
   37   48       780000
73- 1M PROJ MAN OFFICE
   49   60       780000
69- 9D DEV CONTR PROCEDURES
    1   10         .0001
CONSULTANTS
 1 1    1
    1
69- 2M CONSULTANT
    1    4       130000
TRAINING
 1 1       1
    6
70- 4T TRAINING CG EVAL TEAM
   13   24       120000
```

```
72- 2M TRAINING SEA SUPPORT PERSONNEL
   39   48        450000
73- 2M TRAINING SEA SUPPORT PERSONNEL
   49   60        450000
72- 3M TRAINING SEA SUPPORT PERSONNEL
   46   48        150000
73- 3M TRAINING SEA SUPPORT PERSONNEL
   49   60        450000
73- 4M FIRST SEA SUPPORT CREW
   58   60        50000
COORDINATION
 1 1          1
   5
69- 8D INTERFACE COORDINATOR
   1   12         50000
70- 8D INTERFACE COORDINATOR
   13   24        500000
71- 9D INTERFACE COORDINATOR
   25   36        400000
72-11D INTERFACE COORDINATOR
   37   48        400000
73- 8D INTERFACE COORDINATOR
   49   60        250000
RESEARCH
   4
SENSORS
 1              1 1
   5
69-15R ADV SENSOR RESEARCH
   9   12         100000
70-19R ADV SENSOR RESEARCH
   13   24        700000
71-20R ADV SENSOR RESEARCH
   25   36        400000
72-22R ADV SENSOR RESEARCH
   37   48        500000
73-20R ADV SENSOR RESEARCH
   49   60        300000
MATERIALS AND COMPONENTS
 1              1   1
   4
70-23R ADV MAT AND COMP RESEARCH
   13   24        1000000
71-22R ADV MAT AND COMP RESEARCH
   25   36        400000
72-24R ADV MAT AND COMP RESEARCH
   37   48        750000
73-22R ADV MAT AND COMP RESEARCH
   49   60        300000
GREAT LAKES AND ESTUARINE REQUIREMENTS
 1              1      1
   5
69-16R STUDY GT LAKES AND ESTUARINE REQ
   01   12        100000
70-22R STUDY GT LAKES AND ESTUARINE REQ
   13   26        200000
71-21R GT LAKES AND ESTUARINE REQ HDWARE RES
   28   36        400000
72-23R GT LAKES AND ESTUARINE REQ HDWARE RES
   37   48        500000
```

```
73-21R GT LAKES AND ESTUARINE REQ HDWARE RES
   49   52       100000
COOPERATIVE EFFORTS
 1            1        1
     5
69-17R SUPPORT COOPERATIVE RES
    1   12       370000
70-24R SUPPORT COOPERATIVE RES
   13   24       600000
71-23R SUPPORT COOPERATIVE RES
   25   36       400000
72-25R SUPPORT COOPERATIVE RES
   37   48       500000
73-23R SUPPORT COOPERATIVE RES
   49   60       400000
MKO
     3
SENSORS
 1                        1 1                       1
     2
69- 3T
    1    4       200000
69- 4
    1   12       225000
HULL AND MOORINGS
 1                        1   1                     1
    12
69- 5T PROCUREMENT MKO FACILITIES
    1   12      2500000
69- 6T RESIDENT INSPECTOR
    5   12        25000
70- 3D PROCUREMENT MKO FACILITIES
   13   23        .0001
70- 5T RES INSPECTOR CG EVAL TEAM
   13   24       185000
71- 3T ANAL ENVIRONMENTAL TEST
   25   36       300000
71- 4T HDWARE SUPPORT 5MKO PLATFORMS
   25   36       350000
71- 5T CONTRACT SUPPORT
   25   36       120000
71- 6T RES INSPECTOR CG EVAL TEAM
   25   36       185000
72- 4T ANAL ENV'RN TEST RESULTS
   37   50       300000
72- 5T HDWARE SUPPORT
   37   48       350000
72- 6T CONTRACT MAINT SUPPORT
   37   48       120000
72- 7T RES INSPECTOR CG EVAL TEAM
   37   48       190000
SEABORNE SUPPORT
 1                        1     1                   1 1
     5
69- 7T SPEC MOD FOR SERVICE SHIPS
    7   12        .0001
70- 6T PROCUREMENT MOD SHIP
   13   16      1500000
70- 7T OPERATION SEA SUPPORT
   19   23       300000
```

```
71- 7T SERVICE SHIP OPERATION
   25   36       900000
72- 8T SERVICE SHIP OPERATION
   37   48       600000
MK1
    4
SENSORS
 1                                    1 1            1
    4
69-:4D DEV MK1 SENSORS
   9    12          .0001
70- 2T LAB TESING SENSORS
   14   24       400000
70-18D ENG DEV MK1 SENSORS
   13   28       1000000
71- 2T LAB TESTING SENSORS
   25   34       300000
HULL AND MOORINGS
 1                                    1   1          1
   16
69-10D DESIGN STUDY DO MOORINGS
   1    12       300000
69-10D CG MOORING TESTS
   2    12          .0001
69-11D ANAL MODEL STUDY BUOY TYPES
   1    11       300000
69-11D PRELIM DESIGN MK1 BUOY
   8    12       300000
70- 9D CG SUPPORT MOORING TESTS
   13   24       100000
70-10D PROC AND TEST MK1 MOORINGS
   13   24       675000
70-11D EVAL MK1 PLATFORM MOCK-UP
   16   20       240000
70-12D MODEL TESTS MK1 DESIGNS
   16   20       160000
70-13D CONTR DEF MK1 PLATFORM
   13   22       300000
70-14D CONTR DEF MK1 DATA ACQ SYSTEM
   13   24       300000
71-15D RESIDENT INSPECTOR
   27   36       100000
71-10D DEV AND PROC 36MK1 PLATFORMS
   25   36     18000000
73- 5T ANALYSIS TEST RESULTS
   49   60       400000
73-10D RES INSPECTOR
   49   56          .0001
73-12D MAINTENANCE
   49   60       300000
73-13D HARDWARE SUPPORT
   52   60      3000000
SEABORNE SUPPORT
 1                                    1     1        1 1
   21
69-12D PRELIM DESIGN SERV SHIP
   8    12         .001
70- 6T PROC MOD SHIP MK0 AND MK1
   13   16      1500000
70-15D DESIGN SERVICE SHIP MK1 AND MK2
```

```
   13   22        450000
70-25D CONSTR FIRST SERVICE SHIP
   23   24       1700000
70-26D DEV OCEAN HANDLING SYSTEM
   23   24        500000
70-27D DEV SUPPORT PROPULSION SYSTEM
   23   24        500000
71- 8T PROC FIRST SERVICE BARGE
   26   36        550000
71-11D CONSTR FIRST SERVICE SHIP
   25   36      19500000
71-12D DEV AND TEST HANDLING SYSTEMS
   25   36        720000
71-13D DEV AND TEST PROPULSION SYSTEMS
   25   36        800000
71-16D RES INSPECTOR SEABORNE SUPPORT
   29   36        800000
72- 9T MOD SECOND SERVICE SHIP
   42   47       1500000
72-10T PROC SECOND SERVICE BARGE
   37   46        500000
72-14D CONSTR SECOND SERVICE SHIP
   37   42      18500000
72-26D CONSTR THIRD SERVICE SHIP
   43   48      17200000
72-15D HANDLING TESTS
   37   45        400000
72-16D PROPULSION TESTS
   37   45        200000
72-17D RES INSPECTOR SEABORNE SUPPORT
   37   48        120000
73- 7T SERVICE SHIP OPERATION
   49   60       1900000
73-14D DEV SEABORNE SUPPORT
   49   60        200000
73-15D RES INSPECTOR SEABORNE SUPPORT
   49   58        120000
SHORE SUPPORT
 1                              1        1        1    1
   13
69-13D PRELIM DESIGN SHORE SUPPORT
    8   12           .0001
70-16D COMM SITE SELECTION
   13   21        200000
70-20D ACQUISITION SHORE SUPPORT SITES
   18   29       1500000
70-21D SHORE SUPPORT SYSTEM DESIGN
   18   29       1000000
70-17D SITE SELECTION
   13   17           .0001
71-14D CONSTRUCT INT SHORE SUPPORT
   30   36       9500000
71-17D RESIDENT INSPECTOR SHORE SUPPORT
   33   36         30000
72-12D DEV AND PROC SITE HARDWARE
   37   45        800000
72-13D CONSTRUCT SECOND COMM SITE
   37   44        800000
72-18D CONSTRUCT SECOND SHORE SUPPORT
   37   48       8570000
```

```
72-190 RESIDENT INSPECTOR SHORE SUPPORT
   37   48       140000
73-160 DEV SHORE SUPPORT SYSTEM
   49   60       200000
73-170 RESIDENT INSPECTOR SHORE SUPPORT
   49   60       110000
MK2
    2
SENSORS
 1                                       1 1
    5
71-180 DEV MK2 SENSORS
   31   36       365000
72-200 END DEV MK2 SENSORS
   37   48       500000
73- 60 LAB TESTING MK2 SENSORS
   49   55       300000
73-111 PROCUREMENT MK2 SENSORS
   55   60      6500000
73-180 ENG DEV MK2 SENSORS
   49   53       140000
HULL AND MOORINGS
 1                                       1   1
    4
71-190 DEV MK2 HARDWARE
   31   36         .0001
72-210 DEV MK2 HARDWARE
   37   48       700000
73- 91 PROCUREMENT MK2 PLATFORMS
   55   60     37000000
73-190 DEV MK2 HARDWARE
   49   53       100000
/*
```

APPENDIX F

COMPILATION LISTING FOR

THE INTEGRATED BUOY DEPLOYMENT COST MODEL

```
C PROGRAM DEPLOYMENT USING GRT CRL DISTANCES AND NAVG POINTS
C    7 OCT  1968 MOD=8  NEW PRT DAY COMP, SELECTED TEST SUMMARY PRINT
C
      DIMENSION CAL(12),XA(5),CTEST(4),HDL1(20),HDL2(20),PNAME(3)
      DIMENSION DNAME(3),SNAME(3),LOAD(51),NAVG(51),NMSTM(50),NNDPY(50)
      DIMENSION ATSEA(50),ATPRT(50),RODYS(50),XSDYS(50),CTYPE(300)
      DIMENSION NUMB(300),BLAT(300),BLNG(300),IDEPTH(300),BCOST(300)
      DIMENSION BLATR(300),PORT2B(300),BUOY2B(300),IAPSOL(20),NSUM(300)
      DIMENSION TCOST(300),KORDER(300),XTYPE(201),NBRM(201),TLAT(201)
      DIMENSION TLNG(201),IDPH(201),CSTB(201),TLATR(200),SPD(8),SPG(9)
      DIMENSION SCPM(8),INCR(4),STP(72),DAY(72),KBC(72),ACPR(72)
      DIMENSION SCST(16,8),ADDC(8),NRYS(9),DIST(9),KPSPD(8)
C
C READ INITIAL PROG DATA
C
      READ(1,502)IDAY,CMON,IYEAR,IHOUR,INCR
  502 FORMAT(16X,I2,A4,I3,4X,I2,23X,4I3)
      READ(1,500)CAL,XA,CTEST
  500 FORMAT(12A4,2X,5A1,2X,4A4)
      DO 3 J=1,8
      READ(1,509)(SCST(I,J),I=1,16)
  509 FORMAT(5X,F5.1,5(F3.0,F5.0,F6.2))
      SPD(J)=SCST(1,J)
    3 CONTINUE
      KCYCLE=0
  701 READ(1,501)KRUN,KRDY,RMON,KRYR,KHR1,KHR2,SPG,KPSPD
  501 FORMAT(2I3,A4,I3,7X,2I3,9F5.1,1X,8I1)
      IF(KHR1)702,702,703
  703 I=1
  706 IF(SPG(I))704,704,705
  705 I=I&1
      GO TO 706
  704 NSS=I-1
  702 READ(1,498)HDL1
      READ(1,498)HDL2
  498 FORMAT(20A4)
  499 FORMAT(1X,20A4)
C
C BASIC DEPLOYMENT INITIALIZATION
C
      KP=1
      NBC=0
  700 KRTNPT=0
      ICNT=0
      LCNT=0
      NBASE=0
      NBDEPZ=0
      NCBUOY=0
      NCRUSE=0
      NBINCR=0
      MONTH=0
      MAXDTH=0
      LNGCRS=0
      MINDTH=90000
```

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```
      GNORTH=-99.9
      GSOUTH=99.9
      GEAST=-180.
      GWEST=180.
      GRTDAY=0.
      DPYDAY=0.
      SEADAY=0.
      TSEAD=0.
      TPRTD=0.
      CDIST=0.
      TDIST=0.
      TDPCST=0.
      TRYCST=0.
      DO 4 I=1,20
      IAPSOL(I)=0
    4 CONTINUE
C
C SET CLOCK TO START MONTH
C
      DO 5 I=1,12
      IF(CMON-CAL(I))5,6,5
    6 GO TO 7
    5 CONTINUE
    7 MONTH=I
      IBDAY=IDAY
      ISDAY=IDAY
      BMON=CMON
      SMON=CMON
      IBYER=IYEAR
      ISYER=IYEAR
      IBHR=IHOUR*100
      MHR10C=IBHR
      IF(KCYCLE-1)604,123,604
C
C READ PORT CARD TEST LAT LNG FOR N,S,E,W MINPRT,MAXPRT,OVRHAL DAYS
C IF PDMIN,PDMAX,OVRHAL =0 VALUES ASSIGNED ARE 4,10,30 DAYS
C
  604 READ(1,503)NPORT,PNAME,PLAT,PY,PLNG,PX,PDMIN,PDMAX,OVRHAL
  503 FORMAT(6X,I3,5X,3A4,F6.1,A1,F6.1,A1,3F3.0)
      IF(PY-XA(1))15,16,15
   15 PLAT=PLAT*(-1.)
      PLATA=ABS(PLAT)
      GO TO 17
   16 PLATA=PLAT
   17 IF(PX-XA(2))18,19,18
   18 PLNG=PLNG*(-1.)
      PLNGA=ABS(PLNG)
      GO TO 20
   19 PLNGA=PLNG
   20 PLATR=PLAT/57.295779
      IF(OVRHAL)905,905,906
  905 OVRHAL=30.
  906 AVSHDY=365. - OVRHAL
      NAVSHD=AVSHDY
      IF(PDMAX)907,907,908
```

```
  907 PDMAX=10.
  908 IF(PDMIN)909,909,910
  909 PDMIN=4.
  910 PDIFF=PDMAX-PDMIN
C
C READ DEPOT CARD TEST LAT LNG FOR N,S,E,W
C
      READ(1,510)NDEPOT,DNAME,DLAT,DY,DLNG,DX
  510 FORMAT(6X,I3,5X,3A4,F6.1,A1,F6.1,A1)
      IF(DY-XA(1))117,118,117
  117 DLAT=DLAT*(-1.)
      DLATA=ABS(DLAT)
      GO TO 119
  118 DLATA=DLAT
  119 IF(DX-XA(2))120,121,120
  120 DLNG=DLNG*(-1.)
      DLNGA=ABS(DLNG)
      GO TO 122
  121 DLNGA=DLNG
  122 DLATR=DLAT/57.295779
C
C SET BASIC SHIP CONSTANTS
C
  123 SACS=SPD(1)
      SDCD=30.
      SDCH=SDCD*24.
      SMCD=99.
      SMCH=SMCD*24.
      HIPB=12.
      OVRSAF=1.33
      SAFFAC=1.00
      PCFCTR=0.94
      BCPDM=2000.
      BCPDA=5000.
      BCPDX=8000.
C
C READ SHIP CARD
C
      READ(1,504)SNAME,KPRINT,SMBC,ASDCD,ASMCD,AHIPB,AOVRSF,ASFFAC,
     1APCFTR,ABCPDM,ABCPDA,ABCPDX
  504 FORMAT(8X,3A4,I3,8X,4F3.0,3F5.2,3F6.0)
      MSBC=SMBC
      IF(ASDCD)126,126,125
  125 SDCD=ASDCD
      SDCH=SDCD*24.
  126 IF(ASMCD)128,128,127
  127 SMCD=ASMCD
      SMCH=SMCD*24.
  128 IF(AHIPB)130,130,129
  129 HIPB=AHIPB
  130 IF(AOVRSF)132,132,131
  131 OVRSAF=AOVRSF
  132 IF(ASFFAC)134,134,133
  133 SAFFAC=ASFFAC
  134 IF(APCFTR)136,136,135
```

```
  135 PCFCTR=APCFTR
  136 IF(ABCPDM)138,138,137
  137 BCPDM=ABCPDM
  138 IF(ABCPDA)140,140,139
  139 BCPDA=ABCPDA
  140 IF(ABCPDX)142,142,141
  141 BCPDX=ABCPDX
  142 DO 144 I=2,14,3
      IF(SMBC-SCST(I,1))144,143,144
  143 NADD=I&1
      NCPM=I&2
      CSTCDY=BCPDA & SCST(NADD,1)
      CSTPDY=PCFCTR*CSTCDY
      CSTPM=SCST(NCPM,1)
      GO TO 145
  144 CONTINUE
C
C WRITE ERROR MESSAGE  SMBC NOT IN COST TABLE
C
      WRITE(3,592)MSBC
  592 FORMAT(1H1,/,' COST VALUES NOT IN COST TABLE FOR SHIP BUOY CAPACIT
     1Y ='I3,' CHECK INPUT CARDS AND TRY AGAIN')
      GO TO 900
  145 DO 146 J=1,8
      ADDC(J)=SCST(NADD,J)
      SCPM(J)=SCST(NCPM,J)
  146 CONTINUE
C
C READ CRUISE LOAD CARD(S),TWO CARDS IF NBR CRUISES = OR GT 25,COUNT BUOYS
C
      DO 915 I=1,51
      LOAD(I)=0
      NAVG(I)=0
  915 CONTINUE
      NTPMDZ=0
      NAVGPT=0
      READ(1,507)(LOAD(I),I=1,25)
  507 FORMAT(4X,25I3)
  511 FORMAT(26I3)
      IF(LOAD(25))912,912,911
  911 READ(1,511)(LOAD(I),I=26,51)
  912 I=1
  165 IF(LOAD(I))166,166,167
  167 I=I&1
      GO TO 165
  166 KCR=I-1
C
C READ CRUISE NAVG POINTS,TWO CARDS IF NBR CRUISES GT 25,COUNT NAVG POINTS
C
      READ(1,507)(NAVG(I),I=1,KCR)
      DO 172 I=1,KCR,2
      NTPMDZ=NTPMDZ & LOAD(I) & LOAD(I&1)
      NAVGPT=NAVGPT & NAVG(I) & NAVG(I&1)
  172 CONTINUE
      NTPNTS=NTPMDZ & NAVGPT
```

```
C
C READ DEPLYMT ORDER CARD(S)
      READ(1,508)(KORDER(J),J=1,NTPNTS)
  508 FORMAT(5X,25I3)
      IF(KCYCLE-1)606,608,606
C
C READ COST CARD TEST FOR INPUT UNIT COSTS
C
  606 READ(1,505)BFXCST,CSTSPK,CHRGFT,SCOPE
  505 FORMAT(6X,F6.0,2X,F5.0,2X,F5.0,2X,F5.2)
      IF(BFXCST)105,105,106
  105 BFXCST=158000.
  106 IF(CSTSPK)107,107,108
  107 CSTSPK=7000.
  108 IF(CHRGFT)109,109,110
  109 CHRGFT=1750.
  110 IF(SCOPE)112,112,113
  112 SCOPE=1.00
  113 CONTINUE
C
C WRITE DEPLOYMENT CONSTANTS PAGE
C
  608 WRITE(3,520)KRUN,KRDY,RMON,KRYR
  520 FORMAT(1H1,/,' RUN NBR ',I3,3X,'DATE 'I2,A4,I3,/)
      WRITE(3,499)HDL1
      WRITE(3,499)HDL2
      WRITE(3,521)IBDAY,BMON,IBYER
  521 FORMAT  (/,' STARTING DEPLOYMENT DATE ='I3,A4,I3,//,' CONSTANTS US
     1ED FOR THIS DEPLOYMENT',/)
      WRITE(3,522)PNAME,PLATA,PY,PLNGA,PX
  522 FORMAT('    PORT',/,'      NAME = '3A4,/,'      LAT  ='F5.1,A1,/,'
     1  LONG ='F5.1,A1,/)
      WRITE(3,523)DNAME,DLATA,DY,DLNGA,DX
  523 FORMAT('    DEPOT',/,'      NAME = '3A4,/,'      LAT  ='F5.1,A1,/,'
     1   LONG ='F5.1,A1,/)
      WRITE(3,524)SNAME,SACS,MSBC,OVRSAF,HIPB
  524 FORMAT('    SHIP',/,'      NAME = '3A4,/,'      AVERAGE CRUISING SPEE
     1D, KTS ='F5.1,/,'      MAXIMUM BUOY CAPACITY        ='I3,/,'      OVE
     2RALL SAFETY FACTOR        ='F6.2,/,'      HOURS TO IMPLANT 1 BUOY
     3  ='F5.1)
      WRITE(3,525)SDCD,SMCD,PDMAX,PDMIN
  525 FORMAT('      DESIRED SEA DAYS PER CRUISE ='F5.1,/,'      MAXIMUM SE
     1A DAYS PER CRUISE ='F5.1,/,'      MAXIMUM PRT DAYS PER CRUISE ='F5.
     21,/,'      MINIMUM PRT DAYS PER CRUISE ='F5.1,/)
      WRITE(3,590)(LOAD(I),I=1,KCR)
  590 FORMAT('      LOAD/CRUISE',/,(5X,25I3))
      WRITE(3,591)(NAVG(I),I=1,KCR)
  591 FORMAT(/,'      NAV POINTS/CRUISE',/,(5X,25I3))
      WRITE(3,497)
      GO TO 950
  497 FORMAT(/)
      WRITE(3,526)CSTPDY
  526 FORMAT('    COSTS',/,'      SHIP',/,'        PORT DAY     = $'F6.0,'00
     1',/)
      WRITE(3,553)CSTCDY
```

```
  553 FORMAT('        SEA DAY      = $'F6.0,'00',/)
      WRITE(3,555)(SPD(I),I=1,8)
  555 FORMAT('        COST PER N MI TRAVELED',/,'          SPEED (KN)'F5.1
     1,7F6.1)
      WRITE(3,557)(SCPMV(I),I=1,8)
  557 FORMAT('             COST ($)'F7.1,7F6.1,/)
  950 WRITE(3,527)BFXCST,CSTSPK,CMRGFT,SCOPE
  527 FORMAT('   BUOY COSTS',/,'      BUOY W/O S/S SENSORS OR MOORING = $
     1'F8.0,/,'      SUBSURFACE SENSOR PACKAGE, EACH = $'F8.0,/,'      MOO
     2RING LINE PER 1000 FT          = $'F8.0,/,'      MOORING SCOPE = 'F5.
     32)
      IF(KCYCLE-1)610,30,610
C
C READ BUOY CARDS,ASSIGN COSTS,COUNT CARDS,TEST LAT LNG N,S,E,W
C
  610 DO 38 I=1,201
      READ(1,506)XTYPE(I),NBRM(I),TLAT(I),BY,TLNG(I),BX,IDPH(I),BD,
     1CSTB(I)
  506 FORMAT(A4,1X,A4,11X,F6.1,A1,F6.1,A1,I6,A1,F7.0)
      IF(XTYPE(I)-CTEST(1))21,30,21
   21 IF(XTYPE(I)-CTEST(4))22,24,22
   22 IF(CSTB(I))23,23,24
   23 CSTB(I)=BFXCST
   24 IF(BY-XA(1))25,26,25
   25 TLAT(I)=TLAT(I)*(-1.)
   26 IF(BX-XA(2))27,28,27
   27 TLNG(I)=TLNG(I)*(-1.)
   28 IF(BD-XA(5))29,102,29
  102 DPTH=IDPH(I)*3.281
      DPTH=DPTH + .5
      IDPH(I)=DPTH
   29 TLATR(I)=TLAT(I)/57.295779
   38 CONTINUE
C
C READ A STOP CARD FOR BUOYS WRITE BUOY COST PAGE
C
   30 DO 174 I=1,NTPNTS
      J=KORDER(I)
      CTYPE(I)=XTYPE(J)
      NUMB(I)=NBRM(J)
      BLAT(I)=TLAT(J)
      BLNG(I)=TLNG(J)
      IDEPTH(I)=IDPH(J)
      BCOST(I)=CSTB(J)
      BLATR(I)=TLATR(J)
  174 CONTINUE
      DO 913 I=1,NTPNTS
      NSUB(I)=0
      TCOST(I)=0.
  913 CONTINUE
      WRITE(3,520)KRUN,KBOY,RMON,KRYR
      WRITE(3,499)HOL1
      WRITE(3,499)HOL2
      WRITE(3,528)
  528 FORMAT(/,19X,'BUOYS - IN ORDER DEPLOYED'/,'           DEGS    DEGS
```

```
     1  DEPTH   BASIC     S/S     TOTAL',/,'      NBR   LAT    LONG    (FT)
     2     COST   PKGS      COST')
      NTSUB=0
      NTDPH=0
      CALL SUBSNR(CTYPE,IDEPTH,BCOST,IAPSOL,NSUB,CSTSPK,CHRGFT,SCOPE,
     1NTPNTS,TCOST,NTSUB,NTDPH,CTEST)
      DO 310 I=1,NTPNTS
      IF(CTYPE(I)-CTEST(4))306,310,306
  306 IF(BLAT(I))300,300,301
  300 BY=XA(4)
      XLAT=ABS(BLAT(I))
      GO TO 302
  301 BY=XA(1)
      XLAT=BLAT(I)
  302 IF(BLNG(I))303,303,304
  303 BX=XA(3)
      XLNG=ABS(BLNG(I))
      GO TO 305
  304 BX=XA(2)
      XLNG=BLNG(I)
  305 WRITE(3,529)NUMB(I),XLAT,BY,XLNG,BX,IDEPTH(I),BCOST(I),NSUB(I),
     1TCOST(I)
  529 FORMAT(4X,A4,F6.1,A1,F7.1,A1,I7,'  $',F7.0,I4,'   $',F7.0,'00')
      TBYCST=TBYCST & TCOST(I)
      LCNT=LCNT & 1
      IF(LCNT-44)310,310,307
  307 WRITE(3,593)
  593 FORMAT(1H1)
      WRITE(3,528)
      LCNT=0
  310 CONTINUE
      ABHCST=TBYCST/NTPMDZ
      NDPAVG=NTDPH/NTPMDZ
      NSRAVG=NTSUB/NTPMDZ
      WRITE(3,530)TBYCST,NTPMDZ
  530 FORMAT(/,'    TOTAL BUOY HARDWARE COST (W/O SPARES)     $'F12.2,//,'
     1    TOTAL NBR OF BUGYS TO BE DEPLOYED = ',I3)
      IF(NDEPOT-NPORT)151,155,151
  151 DIFF=ABS(PLNG-DLNG)
      IF(DIFF-180.)154,154,153
  153 DIFF=360.-DIFF
  154 RLNG=DIFF/57.295779
      GCA=SIN(PLATR)*SIN(DLATR)&COS(PLATR)*COS(DLATR)*COS(RLNG)
      ARCRAD=ATAN((SQRT(1.-GCA**2)/GCA))
      IF(ARCRAD)210,212,212
  210 ARCRAD=3.14159 & ARCRAD
  212 ARCDEG=ARCRAD*57.295779
      PORT2D=ARCDEG*60.11031
C
C COMPUTE PORT TO BUOY DISTANCES
C
  155 DO 40 I=1,NTPNTS
      DIFF=ABS(PLNG-BLNG(I))
      IF(DIFF-180.)36,36,34
   34 DIFF=360.-DIFF
```

```
   36 RLNG=DIFF/57.295779
      GCA=SIN(PLATR)*SIN(BLATR(I))&COS(PLATR)*COS(BLATR(I))*COS(RLNG)
      ARCRAD=ATAN((SQRT(1.-GCA**2)/GCA))
      IF(ARCRAD)214,216,216
  214 ARCRAD=3.14159 & ARCRAD
  216 ARCDEG=ARCRAD*57.295779
      PORT2B(I)=ARCDEG*60.11031
   40 CONTINUE
C
C COMPUTE BUOY TO BUOY DISTANCES
C
      K=NTPNTS-1
      DO 50 I=1,K
      DIFF=ABS(BLNG(I)-BLNG(I&1))
      IF(DIFF-180.)46,46,44
   44 DIFF=360.-DIFF
   46 RLNG=DIFF/57.295779
      GCA=SIN(BLATR(I))*SIN(BLATR(I&1))&COS(BLATR(I))*COS(BLATR(I&1))
     1*COS(RLNG)
      ARCRAD=ATAN((SQRT(1.-GCA**2)/GCA))
      IF(ARCRAD)218,220,220
  218 ARCRAD=3.14159 & ARCRAD
  220 ARCDEG=ARCRAD*57.295779
      BUOY2B(I)=ARCDEG*60.11031
   50 CONTINUE
C
C COMPUTE DEPLOYMENT TO FIRST BUOY FROM PORT/DEPOT IF NC=NZ
C
      NCRUSE=NCRUSE & 1
      NBLOAD=LOAD(NCRUSE)
      NCRPTS=NBLOAD & NAVG(NCRUSE)
      NZBUOY=0
      NBDATE=0
   10 NCBUOY=NZBUOY
   12 NCBUOY=NCBUOY&1
      I=NCBUOY
      IF(NZBUOY-(NCBUOY-1))54,53,54
   53 IF(NDEPOT-NPORT)156,52,156
  156 HR=SAFFAC*(PORT2D/SACS)
      CDIST=CDIST&PORT2D
      SEADAY=SEADAY&(HR/24.)
      DPYDAY=DPYDAY&(HR/24.)
      KCLK=1
      TIME=HR
      CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IHOUR,CMON,CAL,ICNT)
      MHR100=IHOUR*100
      DIFF=ABS(DLNG-BLNG(I))
      IF(DIFF-180.)159,159,158
  158 DIFF=360.-DIFF
  159 RLNG=DIFF/57.295779
      GCA=SIN(DLATR)*SIN(BLATR(I))&COS(DLATR)*COS(BLATR(I))*COS(RLNG)
      ARCRAD=ATAN((SQRT(1.-GCA**2)/GCA))
      IF(ARCRAD)222,224,224
  222 ARCRAD=3.14159 & ARCRAD
  224 ARCDEG=ARCRAD*57.295779
```

```
      DEPO2B=ARCDEG*60.11031
      DXB=DEPO2B
      DFP=PORT2B(I)
      HRS=SAFFAC*((DXB&DFP)/SACS) & HIPB
      IF(CTYPE(I)-CTEST(4))55,176,55
  176 HRS=HRS-HIPB
      GO TO 55
   52 DXB=PORT2B(I)
      DFP=PORT2B(I)
      HRS=SAFFAC*((2.*DXB)/SACS) & HIPB
      IF(CTYPE(I)-CTEST(4))55,177,55
  177 HRS=HRS-HIPB
      GO TO 55
C COMPUTE DEPLOYMENT TO NEXT BUOY IF NC GT NZ
   54 J=I-1
      DXB=BUOY2B(J)
      DFP=PORT2B(I)
      HRS=SAFFAC*((DXB&DFP)/SACS) & HIPB
      IF(CTYPE(I)-CTEST(4))55,178,55
  178 HRS=HRS-HIPB
C CHECK TIME AGAINST DES AND MAX SEA DAYS
   55 TCHK=SEADAY*24.&HRS
      IF(TCHK-SDCH)56,57,57
   56 GO TO 60
   57 IF(TCHK-SMCH)58,59,59
   58 KRTNPT=KRTNPT-1
C PAST DES SEA DAYS PLANT BUOY,PRINT MESSAGE,CONTINUE DEPLOYMENT
      GO TO 60
   59 KRTNPT=2
C PAST MAX SEA DAYS,PRINT MESSAGE,RETRUN TO PORT
   60 IF(KPRINT)62,62,615
  615 IF(NBIMCR)61,61,62
   61 WRITE(3,620)KRUN,KRDY,RMON,KRYR
      WRITE(3,499)HDL1
      WRITE(3,499)HDL2
      WRITE(3,531)
  531 FORMAT(/,16X,'CRUISE DEPLOYMENT SUMMARY',/)
      WRITE(3,532)SNAME,NCRUSE
  532 FORMAT(1X,3A4,'    CRUISE 'I2,/)
      IF(NDEPOT-NPORT)168,169,168
  168 WRITE(3,593)PNAME,ISDAY,SMON,ISYER
  593 FORMAT(' DEPARTED '3A4,' ON'I3,A4,I3,/)
  169 WRITE(3,533)NBLOAD,DNAME,IDAY,CMON,IYEAR,MHR100,SEADAY
  533 FORMAT(' ON-LOADED',I3,' BUOYS AT '3A4,/, ' SHIP UNDERWAY',I3,A4,I
     13,' AT 'I4,' HRS, SEADAYS ='F4.1,//)
      WRITE(3,534)
  534 FORMAT(' BUOYS IMPLANTED IN FOLLOWING ORDER',//,' BUOY   DEGS   DE
     1GS     N MI    N MI TO     DATE      SEA   DPLYMT',/,' NBR     LAT   LO
     2NG     BTWN      PORT                DAY      DAY')
C
C PLANT BUOY,CALL CLOCK,SET CNTRS
   62 IF(KRTNPT-2)63,68,68
   68 WRITE(3,535)NUMB(I)
  535 FORMAT(1H1,/,' EXCEEDED MAX NBR OF SEA DAYS TO IMPLANT BUOY 'A4,/,
     1' REORDER BUOYS AND DO ANOTHER DEPLOYMENT')
```

```
      GO TO 900
   63 CDIST=CDIST&DXB
      HR=SAFFAC*(DXB/SACS) & HIPR
      IF(CTYPE(I)-CTEST(4))179,180,179
  180 HR=HR-HIPR
  179 SEADAY=SEADAY&(HR/24.)
      DPYDAY=DPYDAY&(HR/24.)
      NBIMCR=NBIMCR&1
      NBDEPZ=NBDEPZ&1
      NBLFTC=NCRPTS-NBIMCR
      KCLK=1
      TIME=HR
      CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IHOUR,CMON,CAL,ICNT)
      PMON=CMON
      IF(BLAT(I))200,200,201
  200 XLAT=ABS(BLAT(I))
      BY=XA(4)
      GO TO 202
  201 XLAT=BLAT(I)
      BY=XA(1)
  202 IF(BLNG(I))203,203,204
  203 XLNG=ABS(BLNG(I))
      BX=XA(3)
      GO TO 205
  204 XLNG=BLNG(I)
      BX=XA(2)
  205 IF(NZBUOY-(NCBUOY-1))64,160,64
  160 IF(NDEPOT-NPORT)161,65,161
  161 IDXB=DEPO2B
      IDFP=PORT2B(I)
      GO TO 162
   64 IDXB=DXB
      IDFP=DFP
      GO TO 162
   65 IDXB=DXB
      IDFP=DXB
  162 IF(KPRINT)617,617,616
  616 WRITE(3,536)NUMB(I),XLAT,BY,XLNG,BX,IDXB,IDFP,IDAY,PMON,SEADAY,
     1DPYDAY
  536 FORMAT(1X,A4,F6.1,A1,F7.1,A1,3X,I4,4X,I5,3X,I2,A4,2X,F5.1,2X,F6.1)
  617 IF(CTYPE(I)-CTEST(4))83,66,83
   83 IF(IDEPTH(I)-MAXDTH)84,84,85
   84 GO TO 86
   85 MAXDTH=IDEPTH(I)
      DMAXLT=BLAT(I)
      DMAXLG=BLNG(I)
   86 IF(IDEPTH(I)-MINDTH)87,87,88
   87 MINDTH=IDEPTH(I)
      DMINLT=BLAT(I)
      DMINLG=BLNG(I)
   88 IF(GNORTH-BLAT(I))90,91,91
   90 GNORTH=BLAT(I)
      GNLONG=BLNG(I)
   91 IF(BLAT(I)-GSOUTH)92,93,93
   92 GSOUTH=BLAT(I)
```

```
      GSLONG=BLNG(I)
   93 IF(GEAST-BLNG(I))94,95,95
   94 GEAST=BLNG(I)
      GELAT=BLAT(I)
   95 IF(BLNG(I)-GWEST)96,100,100
   96 GWEST=BLNG(I)
      GWLAT=BLAT(I)
  100 IF(KPRINT)66,66,618
  618 IF(KRTNPT&1)66,67,66
   66 IF(NBLFTC)70,70,12
C
C IF NBLFTC=0 CRUISE COMPLETED COMPUTE VAR FOR PRINT OUT
   67 WRITE(3,537)
  537 FORMAT(/,' EXCEEDED DESIRED SEA DAYS TO IMPLANT ABOVE BUOY',/)
      GO TO 66
   70 CDIST=CDIST&DFP
      HR=SAFFAC*(DFP/SACS)
      SEADAY=SEADAY&(HR/24.)
      DPYDAY=DPYDAY&(HR/24.)
      NBLFTZ=NTPNTS-NBDEPZ
      NMICR=CDIST
      NBIMCR=NBIMCR-NAVG(NCRUSE)
      NBDATE=NBDATE&NBIMCR
      NBTODO=NTPMDZ-NBDATE
      KCLK 1
      TIME=HR
      CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IHOUR,CMON,CAL,ICNT)
      MHR100=IHOUR*100
      IF(KPRINT)620,620,619
  619 WRITE(3,538)PNAME,IDAY,CMON,IYEAR,MHR100
  538 FORMAT(//,' SHIP RETURNED TO '3A4,' ON'I3,A4,I3,' AT 'I4,' HRS',/)
      WRITE(3,539)NMICR,NBIMCR,NBDATE,NBTODO
  539 FORMAT(' N MILES STEAMED THIS CRUISE  ='I6,//,' BUOYS IMPLANTED TH
     1IS CRUISE  ='I3,//,' TOTAL BUOY IMPLANTED TO DATE ='I3,/,' BUOYS R
     2EMAINING TO BE DPLYD  ='I3,/)
  620 PRTDAY=(PDIFF*(NBLOAD/SMBC)) & PDMIN
      IF(PRTDAY-PDMAX)116,116,115
  115 PRTDAY=PDMAX
  116 DPYDAY=DPYDAY & PRTDAY
      XDAY=DPYDAY*OVRSAF
      TCRCST=((CSTCDY*SEADAY)&(CSTPDY*PRTDAY)&(CDIST*CSTPM))
      XCOST=TCRCST*OVRSAF
      TDPCST=TDPCST & TCRCST
      XTCST=TDPCST*OVRSAF
      N=NCRUSE
      NMSTM(N)=NMICR
      NBDPY(N)=NBIMCR
      ATSEA(N)=SEADAY
      ATPRT(N)=PRTDAY
      RODYS(N)=SEADAY & PRTDAY
      XSDYS(N)=OVRSAF*(SEADAY&PRTDAY)
C
C CAL CLOCK TO RECORD IN PORT TIME
      KCLK=2
      TIME=PRTDAY
```

```
      CALL CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IHOUR,CMON,CAL,ICNT)
      ISDAY=IDAY
      SMON=CMON
      ISYER=IYEAR
      MHR100=IHOUR*100
      IF(KPRINT)622,622,621
  621 WRITE(3,540)SEADAY,PRTDAY
  540 FORMAT(' MINIMUM PSBL SEA DAYS FOR THIS CRUISE = 'F5.1,/,' MINIMUM
     1 REQUIRED PORT DAYS              = 'F5.1,/)
      WRITE(3,541)DPYDAY,XDAY
  541 FORMAT(' MINIMUM PSBL DEPLOYMENT DAYS TO DATE  = 'F5.1,//,' MIN DP
     1LYMT DAYS X SAFETY FACTOR        = 'F5.1,/)
      WRITE(3,594)CSTCDY
  594 FORMAT(' ------------ AT $'F6.0,'00 PER SEA DAY -------------')
      WRITE(3,542)TCRCST,XCOST,TDPCST,XTCSY
  542 FORMAT(' MINIMUM SHIP COST FOR THIS CRUISE      $'F10.0,'00',/,' MI
     1N SHIP COST X SAFETY FACTOR           $'F10.0,'00',//,' TOTAL MINIMU
     2M SHIP COST TO DATE         $'F10.0,'00',//,' TOTAL MIN COST X SAFET
     3Y FACTOR         $'F10.0,'00')
  622 IF(NBLFTZ)80,80,74
C
C MORE BUOYS LEFT TO DEPLOY DETERMINE NBLOAD
C DO ANOTHER DEPLOYMENT CRUISE
C
   74 NCRUSE=NCRUSE&1
      NBLOAD=LOAD(NCRUSE)
      NCRPTS=NBLOAD & NAVG(NCRUSE)
      NZBUOY=NBDEPZ
      TSEAD=TSEAD&SEADAY
      TDIST=TDIST&CDIST
      TPRTD=TPRTD&PRTDAY
      TDPYD=TSEAD&TPRTD
      NRINCR=0
      CDIST=0.
      SEADAY=0.
      KRTNPT=0
      GO TO 10
C
C ALL MDZ BUOYS DEPLYD WRITE CRUISE SUMMARY PAGE
C
   80 WRITE(3,520)KRUN,KRDY,RMON,KRYR
      WRITE(3,499)HDL1
      WRITE(3,499)HDL2
      TDIST=TDIST&CDIST
      TSEAD=TSEAD&SEADAY
      TPRTD=TPRTD&PRTDAY
      TDPYD=TSEAD&TPRTD
      IF(GWLAT)400,401,401
  400 XWLT=XA(4)
      GO TO 402
  401 XWLT=XA(1)
  402 GWLAT=ABS(GWLAT)
      IF(GWEST)403,404,404
  403 XWLG=XA(3)
      GO TO 405
```

```
404 XWLG=XA(2)
405 GWEST=ABS(GWEST)
    IF(GNORTH)406,407,407
406 XNLT=XA(4)
    GO TO 408
407 XNLT=XA(1)
408 GNORTH=ABS(GNORTH)
    IF(GNLONG)409,410,410
409 XNLG=XA(3)
    GO TO 411
410 XNLG=XA(2)
411 GNLONG=ABS(GNLONG)
    IF(GELAT)412,413,413
412 XELT=XA(4)
    GO TO 414
413 XELT=XA(1)
414 GELAT=ABS(GELAT)
    IF(GEAST)415,416,416
415 XELG=XA(3)
    GO TO 417
416 XELG=XA(2)
417 GEAST=ABS(GEAST)
    IF(GSOUTH)418,419,419
418 XSLT=XA(4)
    GO TO 420
419 XSLT=XA(1)
420 GSOUTH=ABS(GSOUTH)
    IF(GSLONG)421,422,422
421 XSLG=XA(3)
    GO TO 423
422 XSLG=XA(2)
423 GSLONG=ABS(GSLONG)
    IF(DMINLT)424,425,425
424 XMILT=XA(4)
    GO TO 426
425 XMILT=XA(1)
426 DMINLT=ABS(DMINLT)
    IF(DMINLG)427,428,428
427 XMILG=XA(3)
    GO TO 429
428 XMILG=XA(2)
429 DMINLG=ABS(DMINLG)
    IF(DMAXLT)430,431,431
430 XMXLT=XA(4)
    GO TO 432
431 XMXLT=XA(1)
432 DMAXLT=ABS(DMAXLT)
    IF(DMAXLG)433,434,434
433 XMXLG=XA(3)
    GO TO 435
434 XMXLG=XA(2)
435 DMAXLG=ABS(DMAXLG)
    WRITE(3,550)
    WRITE(3,552)IBDAY,BMON,IBYER,IBHR
    WRITE(3,554)
```

```
      WRITE(3,556)(N,NBDPY(N),NMSTM(N),ATSEA(N),ATPRT(N),RODYS(N),
     1XSDYS(N),N=1,KCR)
      MAVGD=TDIST/NTPMDZ
      MDIST=TDIST
      WRITE(3,558)KCR,NTPMDZ,MDIST,TSEAD,TPRTD,TOPYD,XDAY
      WRITE(3,595)CSTCDY
      WRITE(3,568)TOPCST
      WRITE(3,570)XTCST
      WRITE(3,572)TBYCST
      WRITE(3,571)NTOPM,NTSUB
      WRITE(3,573)NOPAVG
      WRITE(3,578)NSRAVG
      WRITE(3,582)ABHCST
      WRITE(3,584)MAVGD
      WRITE(3,574)
      WRITE(3,576)SACS
      WRITE(3,577)MSBC
      WRITE(3,580)HIPB
      WRITE(3,585)
      WRITE(3,586)
      WRITE(3,587)GWLAT,XWLT,GWEST,XWLG,GNORTH,XNLT,GNLONG,XNLG,GELAT,
     1XELT,GEAST,XELG,GSOUTH,XSLT,GSLONG,XSLG
      WRITE(3,588)MINDTH,OMINLT,XMILT,OMINLG,XMILG
      WRITE(3,589)MAXDTH,OMAXLT,XMXLT,OMAXLG,XMXLG
C
C DO RECYCLE TESTS FOR VARIABLE SPEED SHIP   HIPB=HIPB&INC
C FIND LONGEST CRUISE IN MILES AND DAYS
C
      DO 623 I=1,KCR
      IF(LNGCRS-NMSTM(I))624,624,625
  624 LNGCRS=NMSTM(I)
  625 IF(GRTDAY-ATSEA(I))626,626,623
  626 GRTDAY=ATSEA(I)
      KK=I
  623 CONTINUE
      TRIP=TSEAD-NTPMDZ*(HIPB/24.)
      CASE=GRTDAY-NBDPY(KK)*(HIPB/24.)
  650 NBASE=NBASE & 1
      GO TO (651,650,652),NBASE
  650 BASIC=BCPDA
      GO TO 670
  651 BASIC=BCPDM
      GO TO 670
  652 BASIC=BCPDX
  670 WRITE(3,563)KRUN,KRDY,RMON,KRYR
      WRITE(3,564)HOL1
      WRITE(3,564)HOL2
      WRITE(3,565)NTPMDZ,PNAME,MSBC
      WRITE(3,566)MDIST,LNGCRS
      WRITE(3,567)BASIC,PCFCTR
      WRITE(3,596)(SPD(I),I=1,8)
      WRITE(3,597)(SCPM(I),I=1,8)
      WRITE(3,598)(ADDC(I),I=1,8)
      WRITE(3,568)NAVSHD
      END
```

```
      DO 630 J=1,4
      INC=INC & INCR(J)
      IMPR=HIPB & INC
      DIPR=NTPMDZ*(IMPR/24.)
      DPBC=NADPY(KK)*(IMPR/24.)
      WRITE(3,549)IMPR,DIPR
      DO 629 I=1,8
      TSEAD=TRIP*(SACS/SPD(I)) & DIPR
      BIGCR=CRSE*(SACS/SPD(I)) & DPBC
      TDPYD=TSEAD & TPRTD
      XDAY=TDPYD*OVRSAF
      CSTCDY=BASIC & ADDC(I)
      CSTPDY=PCFCTR*CSTCDY
      TDPCST=((CSTCDY*TSEAD)&(CSTPDY*TPRTD)&(TDIST*SCPM(I)))/1000.
      XTCST=TDPCST*OVRSAF
      ABDPC=TDPCST/NTPMDZ
      AMDPB=TDPYD/NTPMDZ
      NBPSY=(AVSHDY/AMDPB) + .5
      IF(KPSPD(I))680,680,682
  680 WRITE(3,551)SPD(I),BIGCR,TSEAD,TPRTD,TDPYD,XDAY,TDPCST,XTCST,
     1ABDPC,AMDPB,NBPSY
  551 FORMAT(16X,F4.1,3F6.1,2F7.1,3F9.1,7X,F5.1,8X,I4)
  682 IF(KHR1)629,629,631
  631 IF(IMPR-KHR1)633,632,633
  633 IF(IMPR-KHR2)629,632,629
  632 IF(NBASE-2)629,653,629
  653 DO 634 L=1,NSS
      IF(SPD(I)-SPG(L))634,635,634
  635 STP(KP)=SPD(I)
      DAY(KP)=TSEAD
      KBC(KP)=NSBC
      ACPB(KP)=ABDPC
      KP=KP&1
      GO TO 629
  634 CONTINUE
  629 CONTINUE
  630 CONTINUE
      IF(NBASE-3)660,654,654
  654 NBC=NBC & 1
      NBYS(NBC)=NTPMDZ
      DIST(NBC)=TDIST
      READ(1,600)OPTION
  600 FORMAT(A4)
      IF(OPTION-CTEST(2))601,602,601
  602 KCYCLE=1
      KRUN=KRUN & 1
      IDAY=IBDAY
      CMON=BMON
      IYEAR=IBYER
      IHOUR=IBHR/100
      GO TO 700
  601 IF(OPTION-CTEST(3))636,603,636
  603 IF(KHR1)637,637,638
  638 CALL GRAPH(STP,DAY,KBC,HDL1,NSS,NBC,KHR1,KHR2,ACPB,NBYS,DIST)
  637 KCYCLE=2
```

```
      IDAY=IBDAY
      CMON=BMON
      IYEAR=IBYER
      IHOUR=IBHR/100
      GO TO 701
  636 IF(KHR1)900,900,640
  640 CALL GRAPH(STP,DAY,KBC,MDL1,NSS,NBC,KHR1,KHR2,ACPD,NBYS,DIST)
      GO TO 900
C
C FORMATS FOR SYSTEM SUMMARY PAGE
C
  550 FORMAT(//,'                    SYSTEM DEPLOYMENT SUMMARY',/)
  552 FORMAT(/,' STARTING DATE = ',I2,A4,I3,' AT ',I4,' HRS'/)
  554 FORMAT(' CRUISE  BUOYS  N MILES  MIN SHIP  MIN SHIP  TOTAL MIN   M
     1IN X',/,'  NBR    DPLYD  STEAMED  SEA DAYS  PRT DAYS  DPLY DAYS  S
     2AFETY')
  556 FORMAT(1X,I3,5X,I3,5X,I5,4X,F5.1,5X,F5.1,5X,F6.1,4X,F6.1)
  558 FORMAT(/,1X,I3,5X,I3,3X,I7,3X,F6.1,4X,F6.1,4X,F7.1,3X,F7.1)
  595 FORMAT(/,' ---------- --- AT $'F6.0,'00 PER SEA DAY --------------'
     1)
  568 FORMAT(' MINIMUM SHIP COST FOR THIS DEPLOYMENT   $'F10.0,'00')
  570 FORMAT  (' MINIMUM SHIP COST X SAFETY FACTOR        $',F10.0,'00')
  572 FORMAT(/,' TOTAL COST FOR BUOY HARDWARE DEPLOYED   $',F10.0,'00',/
     1)
  571 FORMAT(' TOTAL FEET OF MOORING REQUIRED  ='I6,/,' TOTAL S/S SENSOR
     1 PACKAGES DPLYD ='I8)
  573 FORMAT(/,' AVERAGE DEPTH PER BUOY IN MDZ            ='I6)
  578 FORMAT(' AVERAGE NBR OF S/S PKGS PER BUOY IN MDZ ='I6)
  582 FORMAT(/,' AVERAGE HARDWARE COST PER BUOY IN MDZ   $'F10.0,'00')
  584 FORMAT(/,' AVERAGE DISTANCE TRAVELED PER BUOY DEPLOYED ='I6,' N MI
     1 ')
  574 FORMAT(/,' SUMMARY OF CONSTANTS USED FOR THIS DEPLOYMENT')
  576 FORMAT  ('    SHIP AVERAGE SPEED      = ',F4.1)
  577 FORMAT('    SHIP MAX BUOY CAPACITY ='I3)
  580 FORMAT('    HRS TO IMPLANT 1 BUOY  = 'F4.1,/)
  585 FORMAT(/,11X,'MAXIMUM GEOGRAPHICAL LOCATIONS')
  586 FORMAT(/,5X,'WEST',10X,'NORTH',11X,'EAST',10X,'SOUTH')
  587 FORMAT  (1X,F4.1,A1,1X,F5.1,A1,3X,F4.1,A1,1X,F5.1,A1,3X,F4.1,A1,
     11X,F5.1,A1,3X,F4.1,A1,1X,F5.1,A1,/)
  588 FORMAT(' THE SHORTEST MOORING WAS ',I5,' FEET AT ',F4.1,A1,1X,F5.1
     1,A1)
  589 FORMAT(' THE DEEPEST  MOOR    AS ',I5,' FEET AT ',F4.1,A1,1X,F5.1
     1,A1)
C
C FORMATS FOR DEPLOYMENT TEST SUMMARY
C
  543 FORMAT(1H1,13X,'RUN NBR ',I3,42X,'DATE ',I2,A4,I3,/,34X'DEPLOYMENT
     1 TEST SUMMARY',/)
  544 FORMAT(14X,20A4)
  545 FORMAT(/,13X,I3,' BUOYS DEPLOYED FROM '3A4,'    SHIP BUOY CAPACITY
     1='I3)
  546 FORMAT(14X,'TOTAL DISTANCE, N MI ='I7,7X,'MAXIMUM CRUISE, N MI ='I
     16)
  547 FORMAT(14X,'BASE COST PER SEA DAY = $'F6.0,'00',3X,'COST/PORT DAY
     1='F4.2,' X SEA DAY',/)
```

```
596 FORMAT(14X,'SPEED KN'5F7.2,3F8.2)
597 FORMAT(14X,'CST/MI $'5F7.2,3F8.2)
598 FORMAT(14X,'$DD/DY $'5F7.2,3F8.2,/)
548 FORMAT(16X,'AVG   MAX   MIN   MIN     MIN     MIN',7X,'DEPLOYMENT CO
   1ST, $K',8X,'AVG  MIN   AVG NBR BUOYS',/,16X,'SHIP  CRSE  SEA   POR
   2T   DPLY   X SAF  MIN DPLY  X SAF   AVG/BUOY',4X,'DPLY DAYS  DPLY
   3PER SHIP',/,16X,'SPD  (DEGS) DAYS  DAYS   DAYS   FCTR     DAYS   F
   4ACTOR    (MIN)',6X,' PER BUOY   IN ',I3,' DAYS ')
549 FORMAT(/,14X,I2,' HRS TO IMPLANT A BUOY, TOTAL TIME TO IMPLANT ='F
   16.1,' DAYS ------')
900 CALL EXIT
    END
```

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IDAY	074C	CMON	0750	IYEAR	0754	IHOUR	0758	J	075C
I	0760	KCYCLE	0764	KRUN	0768	KRDY	076C	PMON	0770
KRYR	0774	KHR1	0778	KHR2	077C	NSS	0780	KP	0784
NBC	0788	KRTNPT	078C	ICNT	0790	LCNT	0794	NBASE	0798
NBDEPZ	079C	NCBUOY	07A0	NCRUSE	07A4	NBINCR	07A8	MONTH	07AC
MAXDTH	07B0	LNGCRS	07B4	MINDTH	07B8	GNORTH	07BC	GSOUTH	07C0
GEAST	07C4	GWEST	07C8	GRTDAY	07CC	DPYDAY	07D0	SEADAY	07D4
TSEAD	07D8	TPRTD	07DC	CDIST	07E0	TDIST	07E4	TDPCST	07E8
TBYCST	07EC	IBDAY	07F0	ISDAY	07F4	BMON	07F8	SMON	07FC
IBYER	0800	ISYER	0804	IBHR	0808	MHR1D	080C	NPORT	0810
PLAT	0814	PY	0818	PLNG	081C	PX	0820	PDMIN	0824
PDMAX	0828	OVRMAL	082C	PLATA	0830	PLNGA	0834	PLATP	0838
AVSHDY	083C	NAVSHD	0840	PDIFF	0844	NDEPOT	0848	DLAT	084C
DY	0850	DLNG	0854	DX	0858	DLATA	085C	DLNGA	0860
DLATR	0864	SACS	0868	SDCD	086C	SDCH	0870	SPCD	0874
SMCH	0878	HIPB	087C	OVRSAF	0880	SAFFAC	0884	PCFCTR	0888
BCPDM	088C	BCPDA	0890	BCPDX	0894	KPRINT	0898	SMBC	089C
ASDCD	08A0	ASMCD	08A4	AHIPB	08A8	ADVRSF	08AC	ASFFAC	08B0
APCFTR	08B4	ABCPDM	08B8	ABCPDA	08BC	ABCPDX	08C0	MSRC	08C4
NADD	08C8	NCPM	08CC	CSTCDY	08D0	CSTPDY	08D4	CSTPK	08D8
NTPMDZ	08DC	NAVGPT	08E0	KCR	08E4	NTPNTS	08E8	RFXCST	08EC
CSTSPK	08F0	CMRGFT	08F4	SCOPE	08F8	BY	08FC	BX	0900
BD	0904	DPTH	0908	NTSUB	090C	NTDPH	0910	XLAT	0914
XLNG	0918	ABHCST	091C	NDPAVG	0920	NSRAVG	0924	DIFF	0928
RLNG	092C	GCA	0930	ARCRAD	0934	ARCDEG	0938	PORT2D	093C
K	0940	NBLOAD	0944	NCRPTS	0948	NZBUOY	094C	NBDATE	0950
HR	0954	KCLK	0958	TIME	095C	DEPO2B	0960	DXB	0964
DFP	0968	HRS	096C	TCHK	0970	NBLFTC	0974	PMON	0978
IDXB	097C	IDFP	0980	DMAXLT	0984	DMAXLG	0988	DMINLT	098C
DMINLG	0990	GNLONG	0994	GSLONG	0998	GELAT	099C	GWLAT	09A0
NBLFTZ	09A4	NMICR	09A8	NBTODO	09AC	PRTDAY	09B0	XDAY	09B4
TCRCST	09B8	XCOST	09BC	XTCST	09C0	N	09C4	TDPYD	09C8
XWLT	09CC	XWLG	09D0	XNLT	09D4	XNLG	09D8	XELT	09DC
XELG	09E0	XSLT	09E4	XSLG	09E8	XMILT	09EC	XMILG	09F0
XMXLT	09F4	XMXLG	09F8	NAVGD	09FC	MDIST	0A00	KK	0A04
TRIP	0A08	CRSE	0A0C	BASIC	0A10	INC	0A14	IMPR	0A18
DIPB	0A1C	DPBC	0A20	BIGCR	0A24	ABDPC	0A28	AMDPR	0A2C
NBPSY	0A30	L	0A34	OPTION	0A38				

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
PNAME	0A3C	DNAME	0A48	SNAME	0A54	CTEST	0A60	INCR	0A70
XA	0A80	SPD	0A94	SCPM	0AB4	ADDC	0AD4	KPSPD	0AF4
SPG	0B14	NRYS	0B38	DIST	0B5C	CAL	0B80	HDL1	0BB0
HDL2	0C00	IAPSOL	0C50	NMSTM	0CA0	NBDPY	0D68	ATSFA	0E30
ATPRT	0EF8	RODYS	0FC0	XSDYS	1088	LOAD	1150	NAVG	121C
STP	12E8	DAY	1408	KBC	1528	ACPB	1648	SCST	1768
TLATR	1968	XTYPE	1C88	NBRM	1FAC	TLAT	2200	TLNG	25F4
IDPH	2918	CSTB	2C3C	CTYPE	2F60	NUMB	3410	BLAT	39C0

	10/08/68	FORTMAIN					0019		
BLNG	3070	IDEPTH	4220	RCOST	4600	BLATR	4B80	PORT2R	5332
RUDY28	54E0	NSUB	5990	TCOST	5E40	KORDER	62F0		

CALLED SUBROUTINES

IJTAAFR	IJTACOM	IJTARXI	SUBSNR	IJTSSCN	SIN	IJTSSCN	COS	IJTSTAN	ATAN
IJTSSQT	SQRT	CLOCK	GRAPH	IJTFXIT	EXIT				

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00502	0088	00500	0108	00509	0184	00003	0186	00701	0192
00501	0234	00703	0262	00706	026A	00705	027E	00704	0294
00702	02A4	00498	02E4	00499	02F0	00700	030E	00004	03F6
00006	042A	00005	0430	00007	0444	00604	04A4	00503	0508
00015	053A	00016	055C	00017	0564	00018	0574	00019	0596
00020	059E	00905	05AC	00906	05C8	00907	0602	00908	067E
00909	061A	00910	0626	00510	0680	00117	06AC	00118	06CE
00119	0606	00120	06E6	00121	0708	00122	0710	00123	0772
00504	0808	00125	0854	00126	086C	00127	0878	00128	0830
00129	089C	00130	08A4	00131	0880	00132	08B8	00133	08C4
00134	08CC	00135	08D8	00136	08E0	00137	08EC	00138	08F4
00139	0900	00140	0908	00141	0914	00142	091C	00143	0940
00144	0996	00592	09CC	00145	0A3C	00146	0A84	00915	0A9C
00507	0A30	00511	0B3E	00911	0B56	00912	0BA8	00165	0B40
00167	0BC8	00166	0BDE	00172	0C70	00508	0CDC	00606	0CFA
00505	0D34	00105	0D5C	00106	0D68	00107	0D74	00108	0D9C
00109	0D8C	00110	0D98	00112	0DA4	00113	0DB0	00608	0E32
00520	0DE8	00521	0E74	00522	0F04	00523	0F8C	00524	1016
00525	1108	00590	11F8	00591	1264	00497	12A6	00526	12C8
00553	1320	00555	138C	00557	1418	00950	143C	00527	1474
00610	1540	00506	1620	00021	1656	00022	1672	00023	159A
00024	169E	00025	16AE	00026	16CC	00027	160C	00028	16FA
00102	170A	00029	1768	00038	178A	00030	179E	00174	183F
00913	184A	00528	180C	00306	1982	00300	19CA	00301	19FE
00302	1A0A	00303	1A22	00304	1A46	00305	1A62	00529	1B78
00307	1880	00593	1898	00310	188C	00530	1C40	00151	1C38
00153	1CDA	00154	1CEA	00210	1D92	00212	1DA2	00155	1D0C
00034	1DF6	00036	1E06	00214	1ED2	00216	1FE2	00040	1F3C
00044	1F62	00046	1F72	00218	2056	00220	2066	00050	2030
00010	20E0	00012	20E8	00053	2116	00156	2126	00158	2136
00159	21C6	00222	2292	00224	22A2	00176	2308	00052	231A
00177	2366	00054	2378	00178	2308	00055	23F4	00056	2438
00057	240E	00058	241E	00059	2434	00060	243C	00615	2448
00061	2454	00531	2404	00532	2520	00168	254E	00583	259C
00169	2580	00533	2604	00534	2670	00062	271E	00068	2732
00535	2768	00063	2708	00180	2814	00179	2820	00200	2842
00201	28C6	00202	28E2	00203	28FA	00204	291E	00205	293A
00160	2954	00161	2964	00064	2986	00065	29FC	00162	2A3C
00616	2A48	00536	2ACC	00617	2AFA	00083	2B16	00084	2B32
00085	2B38	00086	2B60	00087	2B7C	00088	2BA4	00090	2BC0
00091	2BDC	00092	2BF8	00093	2C14	00094	2C30	00095	2C4C
00096	2C68	00100	2C84	00618	2C90	00066	2CA4	00067	2C96
00537	2CD0	00070	2D12	00619	2D0E	00538	2E24	00539	2E9C
00620	2F2A	00115	2F6A	00116	2F72	00621	306C	00540	3034
00541	311C	00594	319C	00542	320C	00622	32DE	00074	32F4
00080	3378	00400	3424	00401	3432	00402	343A	00403	345C
00404	345E	00405	3466	00406	347C	00407	34B4	00408	3472
00409	34A8	00410	3486	00411	348E	00412	3404	00413	34F2

10/08/68 FORTMAIN 000020

00414	34EA	00415	3500	00416	350E	00417	3516	00418	352C
00419	353A	00420	3542	00421	3558	00422	3566	00423	356E
00424	3584	00425	3592	00426	359A	00427	35B0	00428	35BE
00429	35C6	00430	35DC	00431	35E4	00432	35F2	00433	3608
00434	3616	00435	361E	00624	3A70	00625	3A80	00626	3A98
00623	3A80	00660	3830	00650	3B68	00651	3B76	00652	3394
00670	3B8C	00680	3F7C	00551	3FFC	00682	4022	00631	402E
00633	403E	00632	404E	00653	4062	00635	408A	00634	4094
00629	40F8	00630	40FC	00654	4124	00600	4168	00602	4192
00601	41C8	00603	41D8	00638	41E4	00637	41F2	00636	422C
00640	4238	00550	424C	00552	4280	00554	4282	00556	433C
00558	4364	00595	438E	00568	[illegible]	00570	440A	00572	4446
00571	4484	00573	44DA	00578	[illegible]	00582	4548	00584	4584
00574	45C8	00576	4602	00577	462C	00580	4654	00585	457F
00586	46AA	00587	4606	00588	4718	00589	4756	00543	4794
00544	47DA	00545	47E8	00546	482C	00547	486C	00596	488C
00597	48DA	00598	48F8	00548	4918	00549	4A3E	00200	4A8C

COMPILATION COMPLETE AMOUNT OF COMMON 000000 AMOUNT OF CORE 045832 ADDRESS BASE TABLE 4A80

```
      SUBROJTINE SUBSNR(CTYPE,IDEPTH,BCOST,IAPSOL,NSUB,CSTSPK,CHRGFT,
     1SCOPE,NTPNTS,TCOST,NTSUB,NTDPH,CTEST)
      DIMENSION CTYPE(200),IDEPTH(200),BCOST(200),IAPSOL(20),NSUB(200)
      DIMENSION TCOST(200),CTEST(4)
      IAPSOL(1)=0
      IAPSOL(2)=33
      IAPSOL(3)=66
      IAPSOL(4)=98
      IAPSOL(5)=164
      IAPSOL(6)=246
      IAPSOL(7)=328
      IAPSOL(8)=492
      IAPSOL(9)=656
      IAPSOL(10)=984
      IAPSOL(11)=1312
      IAPSOL(12)=1641
      IAPSOL(13)=1969
      IAPSOL(14)=2625
      IAPSOL(15)=3281
      IAPSOL(16)=4922
      IAPSOL(17)=6562
      IAPSOL(18)=9843
      IAPSOL(19)=13124
      IAPSOL(20)=16405
      DO 30 J=1,NTPNTS
      IF(CTYPE(J)-CTEST(4))8,30,8
    8 DO 15 I=1,20
      IF(IDEPTH(J)-IAPSOL(I))10,12,15
   10 BFLAST=(IDEPTH(J)-IAPSOL(I-1))
      TEST=.3*(IAPSOL(I)-IAPSOL(I-1))
      IF(BFLAST-TEST)11,12,12
   11 I=I-1
   12 NSUB(J)=I
      GO TO 25
   15 CONTINUE
      NSUB(J)=20
   25 CSTSUB=CSTSPK*NSUB(J)
      CSTHRG=CHRGFT/1000.*(IDEPTH(J)*SCOPE)
      TCOST(J)=BCOST(J) & CSTSUB & CSTHRG
      NTSUB=NTSUB & NSUB(J)
      NTDPH=NTDPH & IDEPTH(J)
   30 CONTINUE
      RETURN
      END
```

```
        10/08/68          SUBSNR                                                                0002

                                                 SCALARS

SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION
J             009C    NTPNTS        0068    I             00A0    BFLAST        00A4    TEST          00A8
CSTSUB        00AC    CSTSPK        007C    CSTNRG        00B0    CNRGFT        0080    SCOPE         0094
NTSUB         0090    NTDPH         0094

                                            CALLED SUBROUTINES
IJTACOM

LABEL     LOCATION    LABEL     LOCATION    LABEL     LOCATION    LABEL     LOCATION    LABEL     LOCATION
00008         01A2    00010         01E0    00011         025C    00012         0268    00015         0296
00025         0282    00030         0350
       COMPILATION COMPLETE    AMOUNT OF COMMON 000000    AMOUNT OF CORE 001160    ADDRESS BASE TABLE    0388
```

```
      SUBROUTINE CLOCK(KCLK,TIME,IDAY,MONTH,IYEAR,IHOUR,CMON,CAL,ICNT)
      DIMENSION CAL(12)
      IF(ICNT)5,5,6
    5 TDAYS=0.
C IF KCLK=1,2,3  TIME IS IN HR,DAY,MON
    6 GO TO(10,12,14),KCLK
C TIME INPUT IS IN HOURS
   10 DAYS=TIME/24.
      SAVE=DAYS
      INTR=DAYS
      XDAY=INTR
      FP=SAVE-XDAY
      TEST=24.*FP
      TEST=TEST&.5
      IADD=TEST
      IDAY=IDAY&INTR
      IHOUR=IHOUR&IADD
      IF(IHOUR-24)15,16,17
   15 TDAYS=TDAYS&DAYS
      GO TO 40
   16 IDAY=IDAY&1
      IHOUR=0
      TDAYS=TDAYS&DAYS
      GO TO 40
   17 IADD=IHOUR-24
      IHOUR=IADD
      IDAY=IDAY&1
      TDAYS=TDAYS&DAYS
      GO TO 40
C [illegible] TIME INPUT IN DAYS
   12 TDAYS=TDAYS&TIME
      ITIME=TIME
      IDAY=IDAY&ITIME
      XTIME=ITIME
      FP=TIME-XTIME
      TEST=24.*FP
      TEST=TEST&.5
      IADD=TEST
      IHOUR=IHOUR&IADD
      IF(IHOUR-24)60,61,62
   60 GO TO 40
   61 IDAY=IDAY&1
      IHOUR=0
      GO TO 40
   62 IADD=IHOUR-24
      IHOUR=IADD
      IDAY=IDAY&1
   40 IF(IDAY-31)18,19,20
   18 GO TO 50
   19 IDAY=1
      MONTH=MONTH&1
   30 IF(MONTH-13)21,22,23
   21 GO TO 50
   22 MONTH=1
```

```
      IYEAR=IYEAR&1
      GO TO 50
   23 IADD=MONTH-13
      MONTH=IADD&1
      IYEAR=IYEAR&1
      GO TO 50
   20 DAYS=IDAY
      XMON=DAYS/30.
      SAVE=XMON
      INTR=XMON
      XMON=INTR
      FP=SAVE-XMON
      TEST=30.*FP
      TEST=TEST&.5
      IADD=TEST
      MONTH=MONTH&INTR
      IDAY=IADD
      GO TO 30
C READ TIME INPUT IN MONTHS
   14 ITIME=TIME
      TIME=TIME*30.
      TDAYS=TDAYS&TIME
      MONTH=MONTH&ITIME
      GO TO 30
   50 ICNT=ICNT&1
      DO 65 I=1,12
      IF(MONTH-I)66,66,65
   66 GO TO 67
   65 CONTINUE
   67 CMON=CAL(I)
      RETURN
      END
```

10/08/68 CLOCK 0003

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
ICNT	00C4	TDAYS	00C8	KCLK	00A4	DAYS	00CC	TIME	0248
SAVE	00D0	INTR	00D4	XDAY	00D8	FP	00DC	TEST	02E0
IADD	00E4	IDAY	00AC	IHOUR	00B8	ITIME	00E8	XTIME	02EC
MONTH	00B0	IYEAR	00B4	XMON	00F0	I	00F4	CMON	024C

CALLED SUBROUTINES

IJTACOM

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00005	00CE	00006	00D6	00010	00FE	00015	01C0	00016	0192
00017	01F8	00012	022A	00060	02E4	00061	02EA	00062	0304
00040	0324	00018	033A	00019	0340	00030	0354	00021	034A
00022	0370	00023	038A	00020	0384	00014	0482	00050	04CA
00066	04EE	00065	04F4	00067	0508				

COMPILATION COMPLETE AMOUNT OF COMMON 000000 AMOUNT OF CORE 001688 ADDRESS BASE TABLE 0559

```
      SUBROUTINE GRAPH (SPD,DDAYS,KBC,HDL1,NSS,NBC,KHR1,KHR2,ACPB,NBYS,
     1TDIS)
      DIMENSION KPC(41), TITLE(17), HOL1(20), KT(24),ACPB(72)
      DIMENSION KBC(72),DDAYS(72),SPD(72),KTBLC(533),KTBLP(533)
      DIMENSION VT(8), ST(8), NBYS(5), TDIS(5)
      CONTINUE
      RETURN
      END
```

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
VT	0070	ST	0090	TITLE	0080	KT	00F4	KPC	0154
KTBLC	01F8	KTBLP	0A4C						

CALLED SUBROUTINES

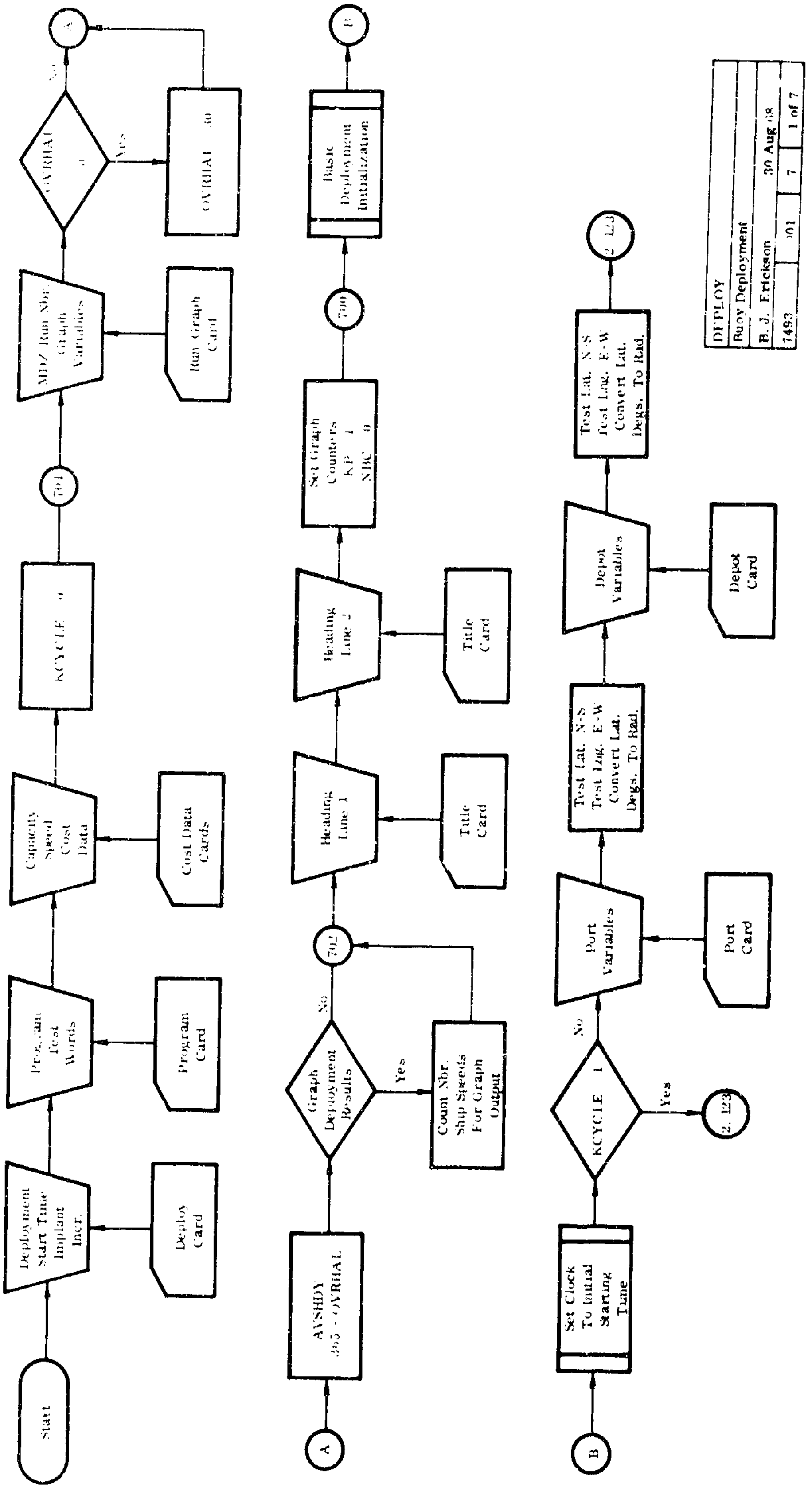
TJTACOM

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION

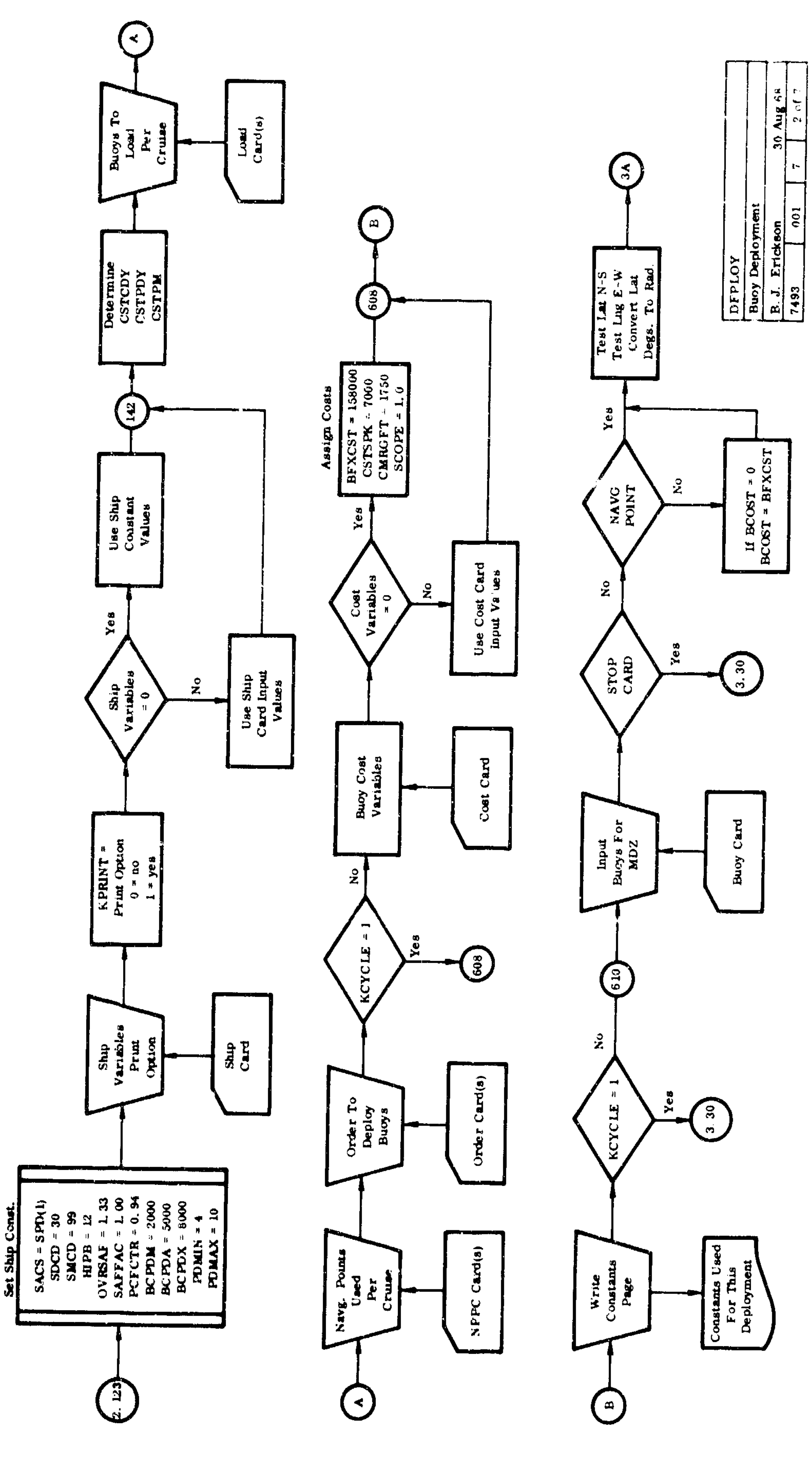
COMPILATION COMPLETE AMOUNT OF COMMON 000000 AMOUNT OF CORE 004992 ADDRESS BASE TABLE 0202

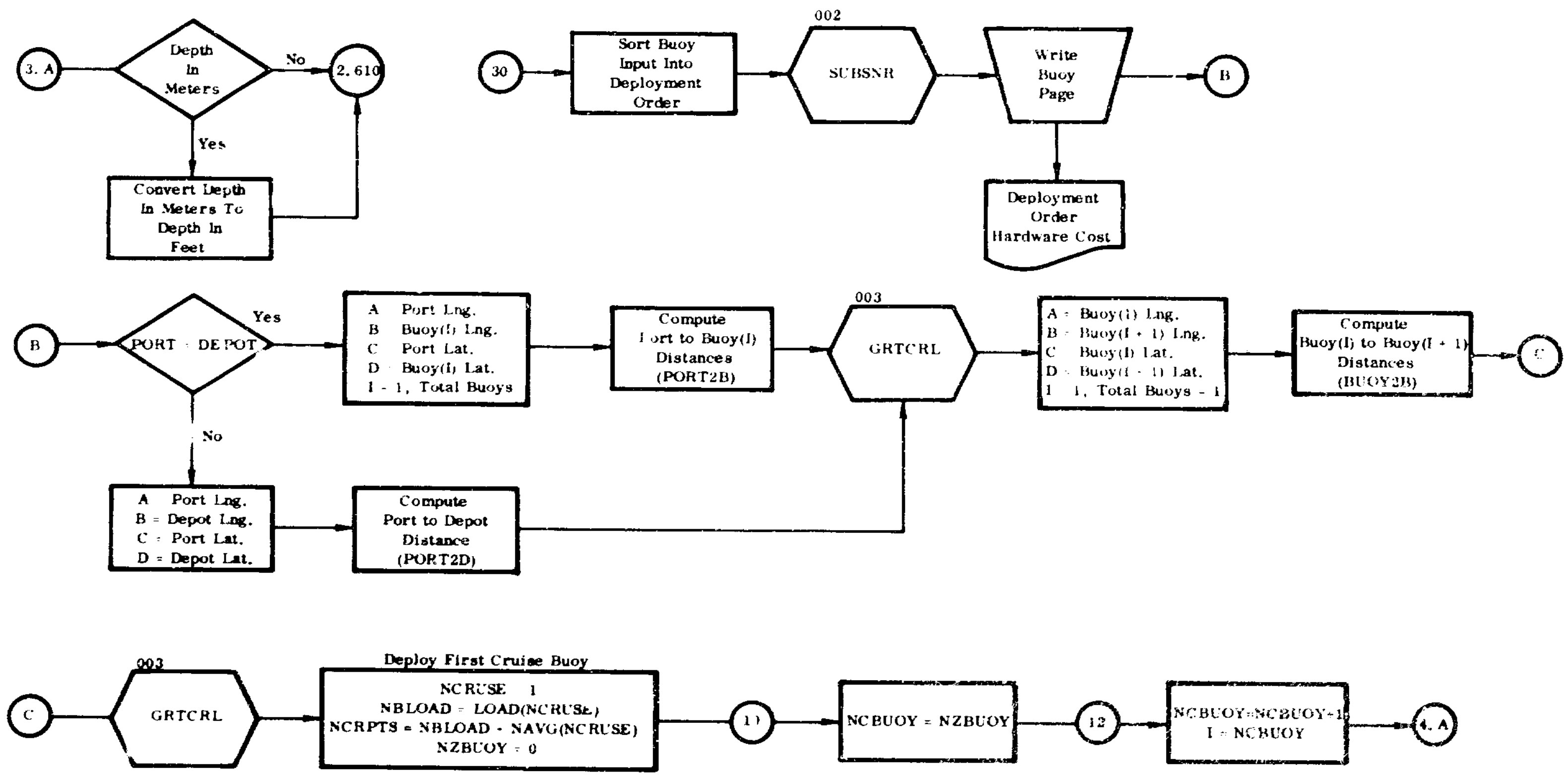
APPENDIX G

MICRO FLOW DIAGRAMS FOR
THE INTEGRATED BUOY DEPLOYMENT COST MODEL

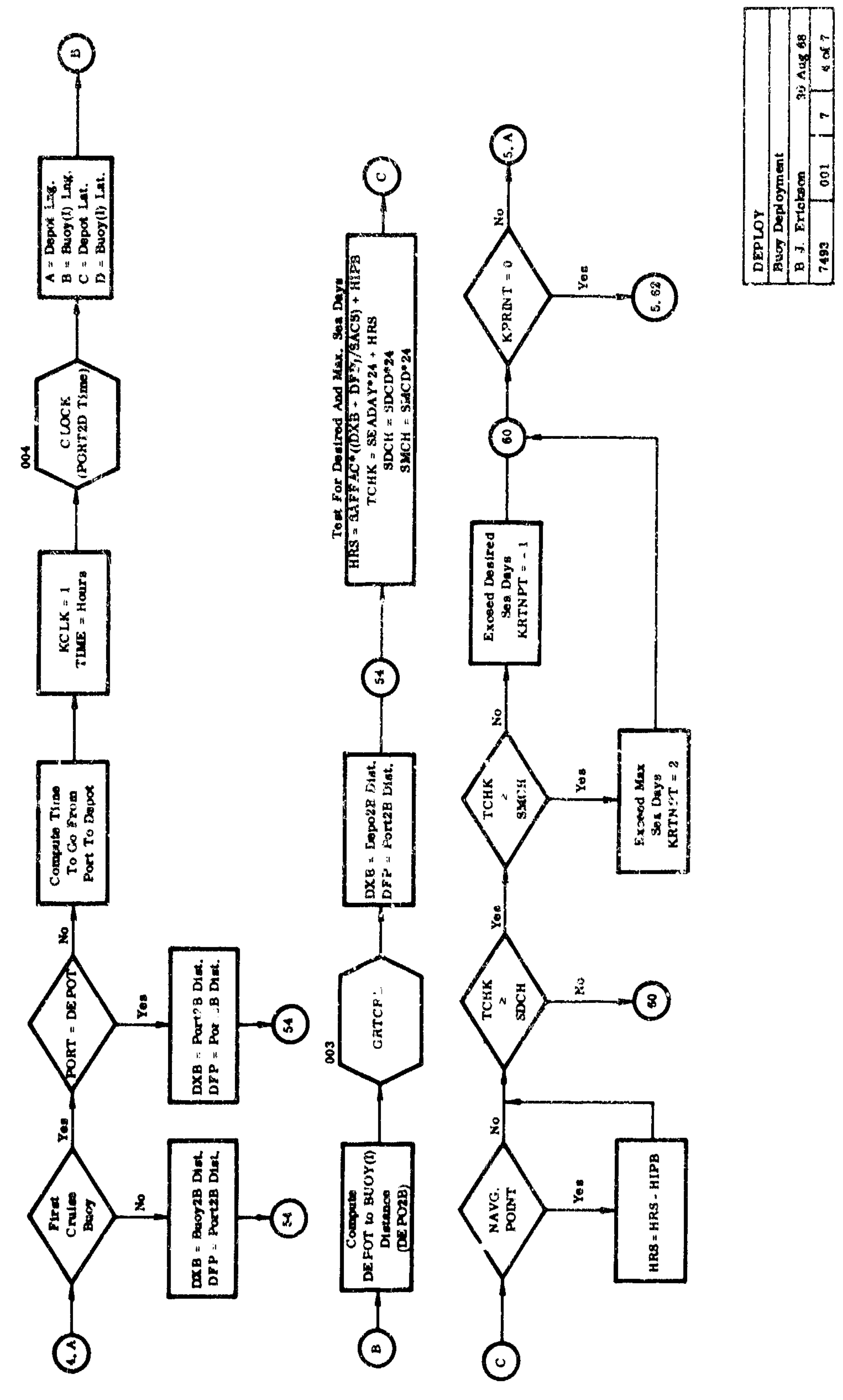


Start
Deployment Start Time Implant Incr.
Deploy Card
Program Test Words
Program Card
Capacity Speed Cost Data
Cost Data Cards
KCYCLE 0
701
MDZ Run Nbr Graph Variables
Run Graph Card
OVRHAL 0
Yes
No
OVRHAL 30
A
AVSHDY 365 - OVRHAL
Graph Deployment Results
Count Nbr. Ship Speeds For Graph Output
702
Heading Line 1
Title Card
Heading Line 2
Title Card
Set Graph Counters KP 1 NBC 0
700
Basic Deployment Initialization
B
Set Clock To Initial Starting Time
KCYCLE 1
2, 123
Port Variables
Port Card
Test Lat. N-S Test Lng. E-W Convert Lat. Degs. To Rad.
Depot Variables
Depot Card
Test Lat. N-S Test Lng. E-W Convert Lat. Degs. To Rad.
2, 123
DEPLOY
Buoy Deployment
B. J. Erickson
30 Aug 68
7493
101
7
1 of 7


Set Ship Const.
SACS = SPD(1)
SDCD = 30
SMCD = 99
HIPB = 12
OVRSAF = 1.33
SAFFAC = 1.00
PCFCTR = 0.94
BCPDM = 2000
BCPDA = 5000
BCPDX = 8000
PDMIN = 4
PDMAX = 10
2.123
Ship Variables Print Option
Ship Card
KPRINT = Print Option 0 = no 1 = yes
Ship Variables = 0
Yes
No
Use Ship Constant Values
Use Ship Card Input Values
142
Determine CSTCDY CSTPDY CSTPM
Buoys To Load Per Cruise
Load Card(s)
A
Navg. Points Used Per Cruise
NPPC Card(s)
Order To Deploy Buoys
Order Card(s)
KCYCLE = 1
608
Buoy Cost Variables
Cost Card
Cost Variables = 0
Use Cost Card Input Values
Assign Costs
BFXCST = 158000
CSTSPK = 7060
CMRGFT = 1750
SCOPE = 1.0
B
Write Constants Page
Constants Used For This Deployment
KCYCLE = 1
3.30
610
Input Buoys For MDZ
Buoy Card
STOP CARD
NAVG POINT
If BCOST = 0 BCOST = BFXCST
Test Lat N-S Test Lng E-W Convert Lat Degs. To Rad.
3A
DFPLOY
Buoy Deployment
B. J. Erickson 30 Aug 68
7493 001 7 2 of 7



DEPLOY			
Buoy Deployment			
B. J. Erickson		30 Aug 68	
7482	001	7	3 of 7



4,A
First Cruise Buoy
Yes
No
DXB = Buoy2B Dist.
DFP = Port2B Dist.
54
PORT = DEPOT
Yes
DXB = Port2B Dist.
DFP = Por .B Dist.
54
No
Compute Time To Go From Port To Depot
KCLK = 1
TIME = Hours
004
CLOCK (PORT2D Time)
A = Depot Lng.
B = Buoy(I) Lng.
C = Depot Lat.
D = Buoy(I) Lat.
B
B
Compute DEPOT to BUOY(I) Distance (DEPO2B)
003
GRTCPL
DXB = Depo2B Dist.
DFP = Port2B Dist.
54
Test For Desired And Max. Sea Days
HRS = SAFFAC*((DXB + DFP)/SACS) + HIPB
TCHK = SEADAY*24 + HRS
SDCH = SDCD*24
SMCH = SMCD*24
C
C
NAVG. POINT
Yes
HRS = HRS - HIPB
No
TCHK ≥ SDCH
No
60
Yes
TCHK ≥ SMCH
Yes
Exceed Max Sea Days
KRTNPT = 2
No
Exceed Desired Sea Days
KRTNPT = -1
60
KPRINT = 0
Yes
5,62
No
5,A
DEPLOY
Buoy Deployment
B. J. Erickson
30 Aug 68
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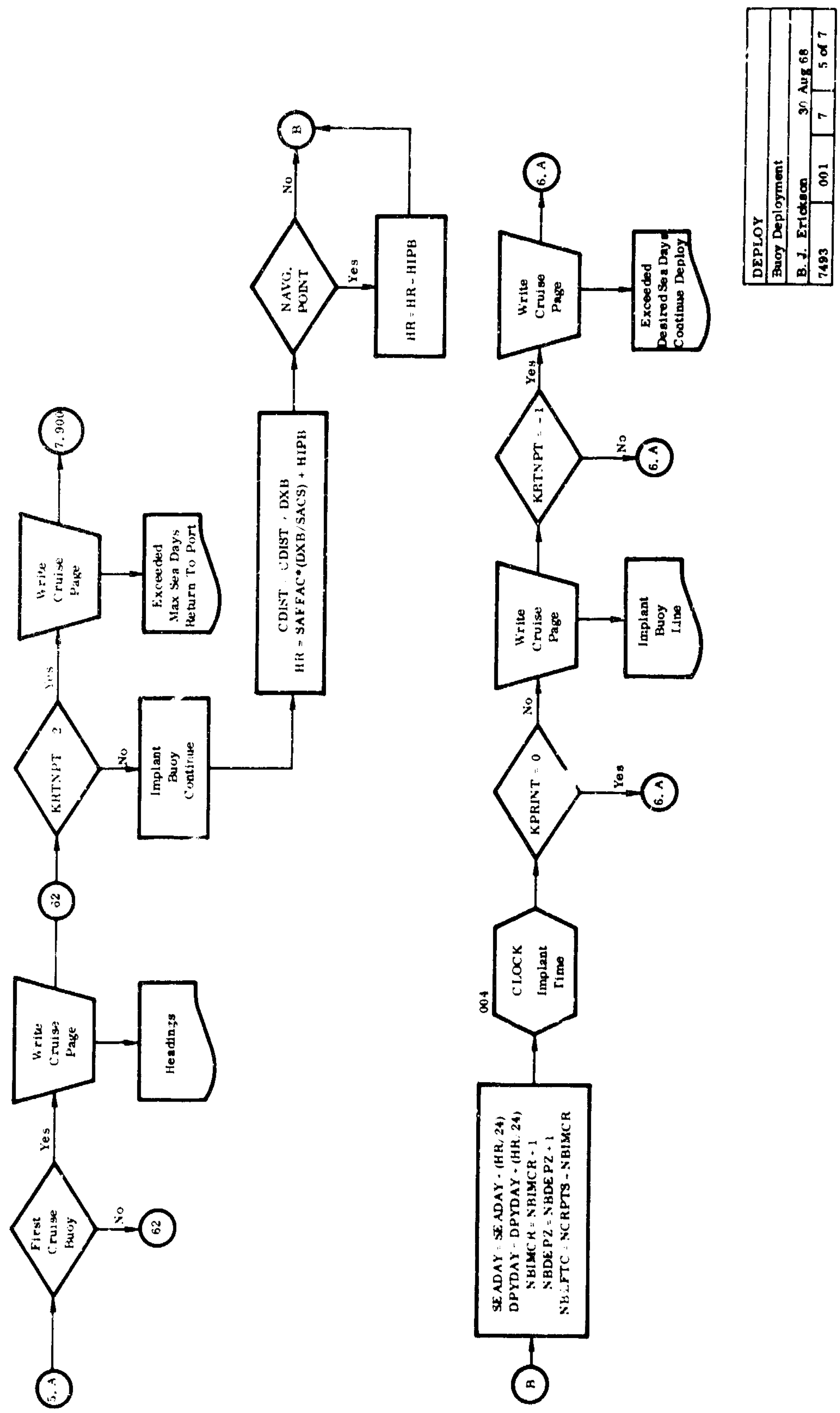
001
7
4 of 7


5. A
First Cruise Buoy
Yes
No
62
Write Cruise Page
Headings
62
KRTNPT 2
Yes
No
Write Cruise Page
Exceeded Max Sea Days Return To Port
7.900
Implant Buoy Continue
CDIST = CDIST + DXB
HR = SAFFAC*(DXB/SACS) + HIPB
NAVG. POINT
Yes
No
B
HR = HR - HIPB
B
SEADAY = SEADAY + (HR/24)
DPYDAY = DPYDAY + (HR/24)
NBIMCR = NBIMCR + 1
NBDEPZ = NBDEPZ + 1
NBLFTC = SCRPTS - NBIMCR
004
CLOCK Implant Time
KPRINT = 0
Yes
6. A
No
Write Cruise Page
Implant Buoy Line
KRTNPT = 1
No
6. A
Yes
Write Cruise Page
Exceeded Desired Sea Days Continue Deploy
6. A
DEPLOY
Buoy Deployment
B. J. Erickson
30 Aug 68
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7
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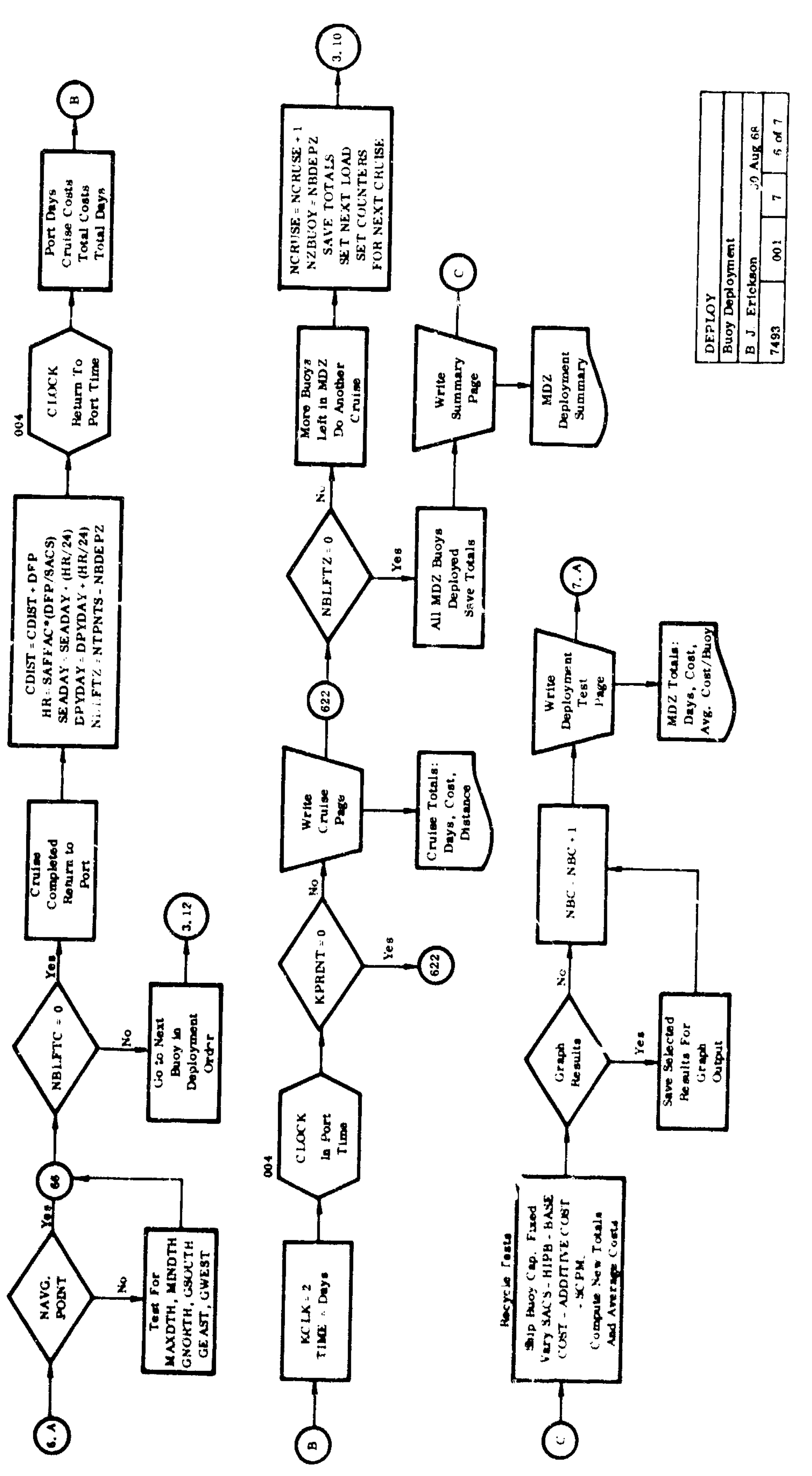
6.A
NAVG. POINT
Yes
No
Test For MAXDTH, MINDTH GNORTH, GSOUTH GEAST, GWEST
66
NBLFTC = 0
Yes
No
Go to Next Buoy in Deployment Order
3.12
Cruise Completed Return to Port
CDIST = CDIST + DFP
HR = SAFFAC*(DFP/SACS)
SEADAY = SEADAY + (HR/24)
DPYDAY = DPYDAY + (HR/24)
NBLFTZ = NTPNTS - NBDEPZ
004
CLOCK Return To Port Time
Port Days Cruise Costs Total Costs Total Days
B
B
KCLK = 2 TIME = Days
004
CLOCK In Port Time
KPRINT = 0
Yes
622
No
Write Cruise Page
Cruise Totals: Days, Cost, Distance
622
NBLFTZ = 0
No
More Buoys Left in MDZ Do Another Cruise
NCRUSE = NCRUSE + 1
NZBUOY = NBDEPZ
SAVE TOTALS
SET NEXT LOAD
SET COUNTERS
FOR NEXT CRUISE
3.10
Yes
All MDZ Buoys Deployed Save Totals
Write Summary Page
C
MDZ Deployment Summary
C
Recycle Tests
Ship Buoy Cap. Fixed
Vary SACS - HIPB - BASE
COST - ADDITIVE COST
- SCPM.
Compute New Totals
And Average Costs
Graph Results
Yes
Save Selected Results For Graph Output
No
NBC = NBC + 1
Write Deployment Test Page
MDZ Totals: Days, Cost, Avg. Cost/Buoy
7.A
DEPLOY
Buoy Deployment
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001
7
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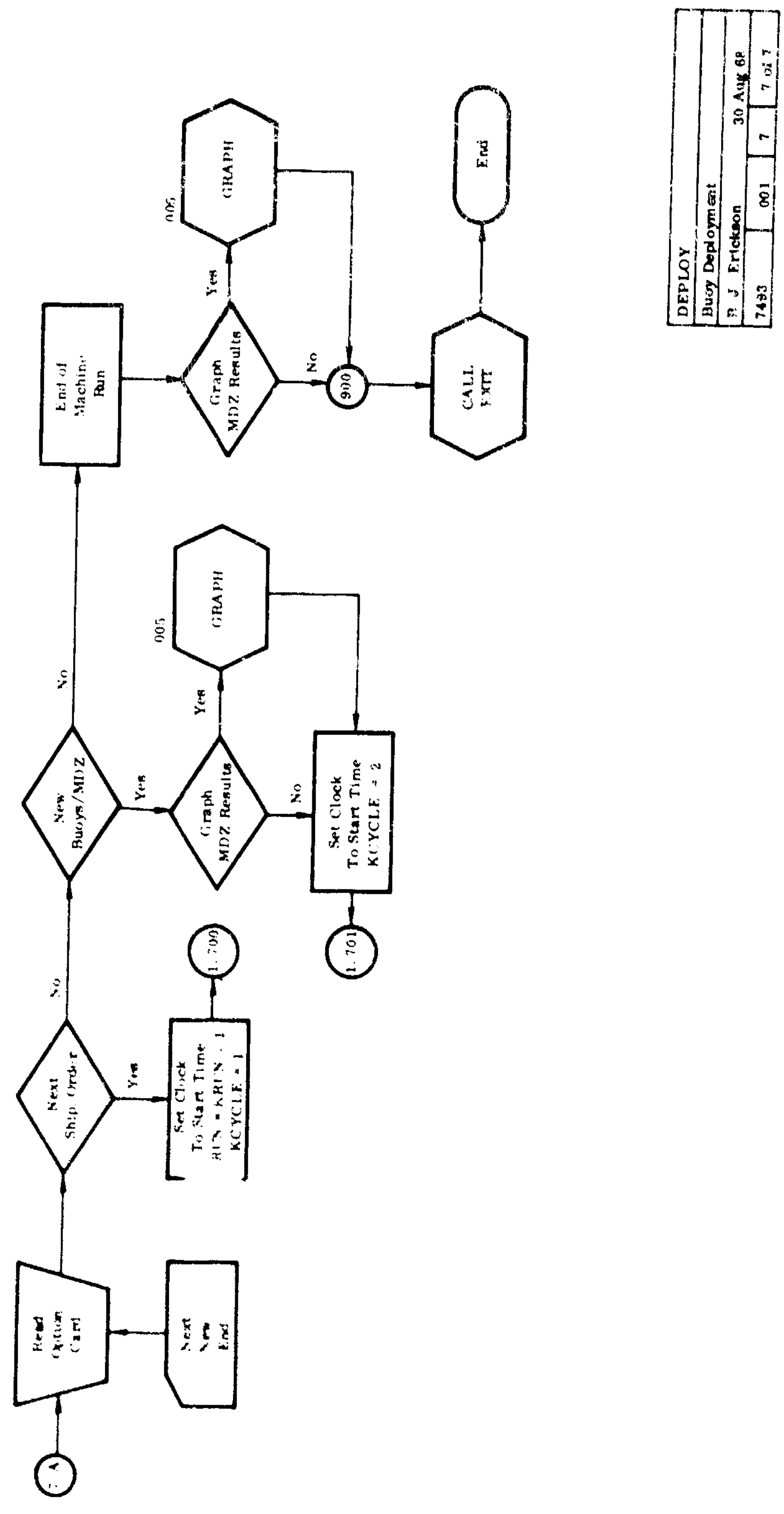

7 A
Read Option Card
Next New End
Next Ship Order
Yes
No
Set Clock To Start Time RUN = KRUN + 1 KCYCLE = 1
1.700
New Buoys/MDZ
Yes
No
Graph MDZ Results
Yes
No
005
GRAPH
Set Clock To Start Time KCYCLE = 2
1.701
End of Machine Run
Graph MDZ Results
Yes
No
005
GRAPH
900
CALL EXIT
End
DEPLOY
Buoy Deployment
B J Erickson
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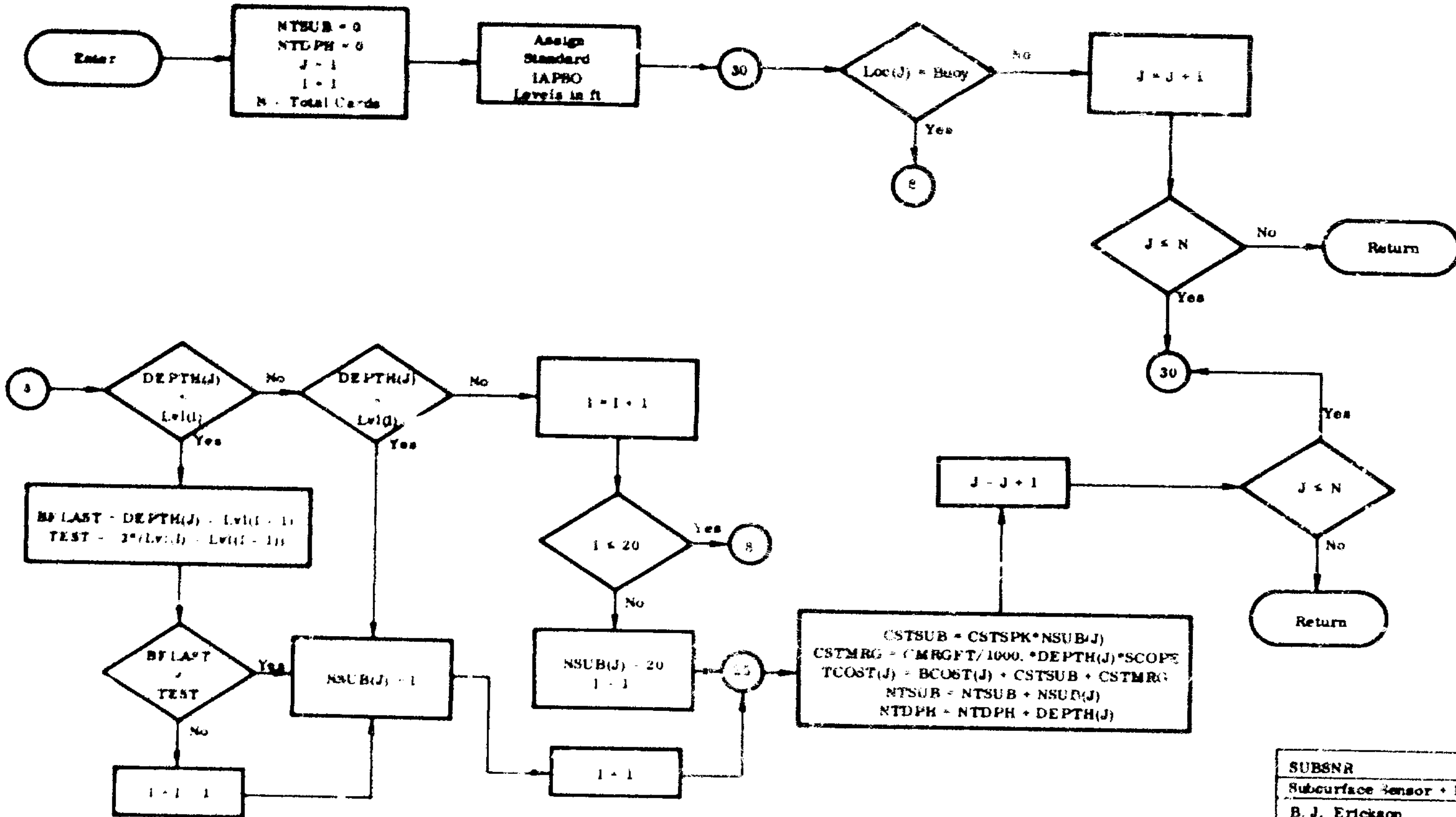
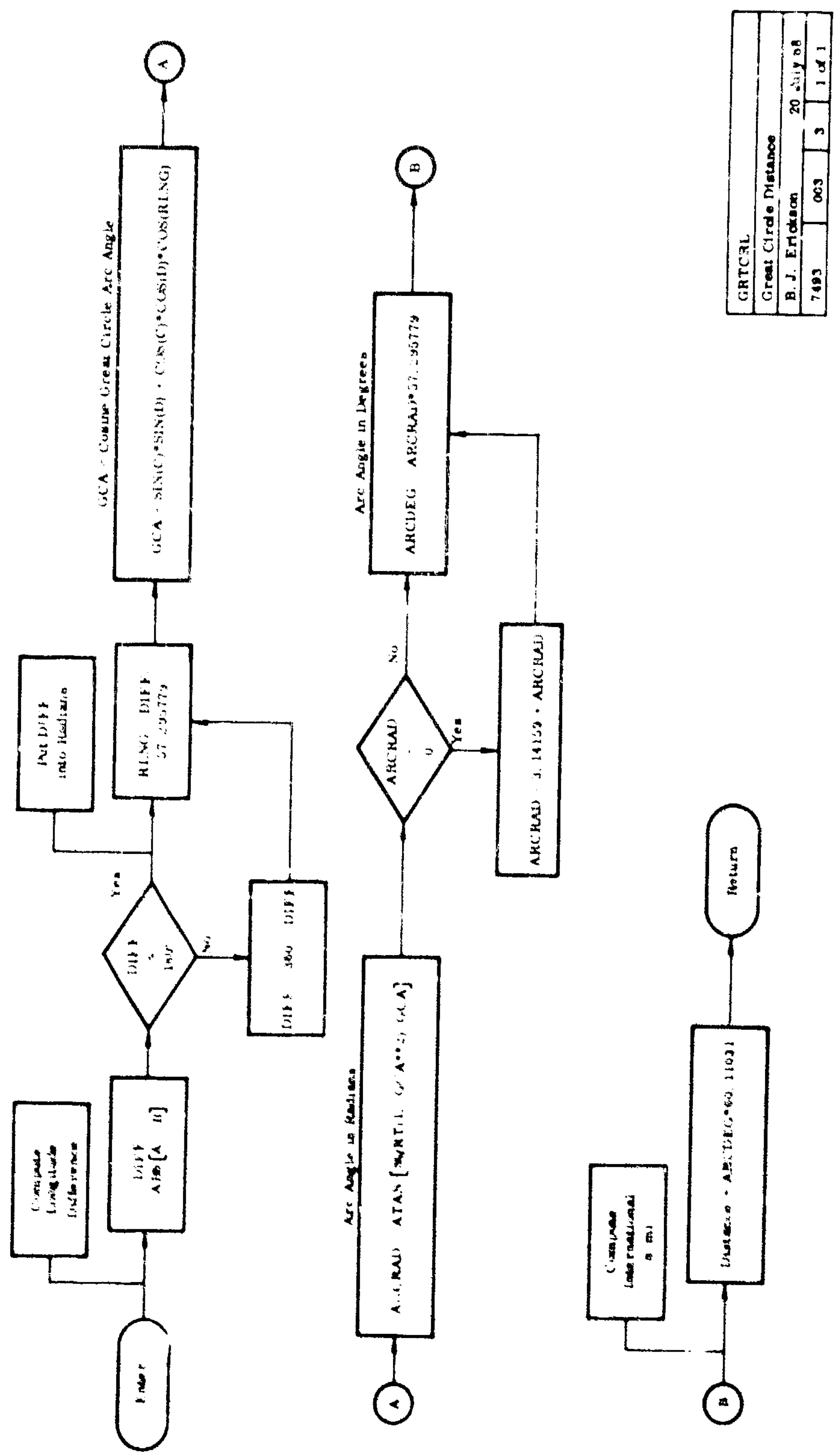
001
7
7 of 7



SUBSNR			
Subsurface Sensor + Mooring Cost			
B. J. Erickson		30 Apr 68	
7493	002	1	1 of 1



GCA - Cosine Great Circle Arc Angle
GCA = SIN(C)*SIN(D) + COS(C)*COS(D)*COS(RLNG)
A
Put DIFF into Radians
RLNG = DIFF / 57.295779
Yes
No
DIFF = 360 - DIFF
Compute Longitude Difference
DIFF = ABS[A - B]
Enter
Arc Angle in Radians
ARCRAD = ATAN [SQRT(1-GCA**2)/GCA]
ARCRAD < 0
ARCRAD = 3.14159 + ARCRAD
Arc Angle in Degrees
ARCDEG = ARCRAD*57.295779
B
Compute International n mi
Return
GRTCRL
Great Circle Distance
B. J. Erickson
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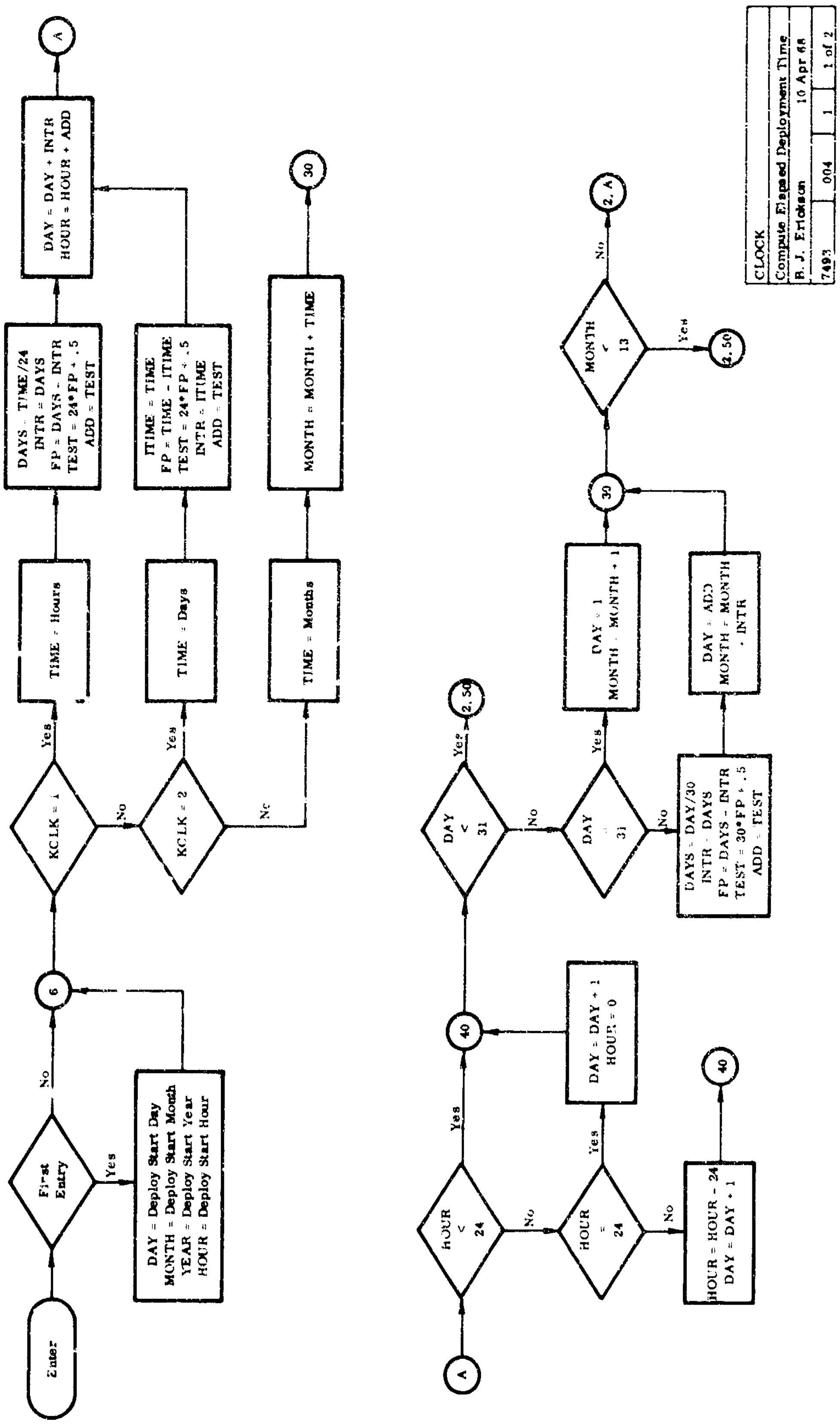

Enter
First Entry
Yes
No
DAY = Deploy Start Day
MONTH = Deploy Start Month
YEAR = Deploy Start Year
HOUR = Deploy Start Hour
6
KCLK = 1
KCLK = 2
TIME = Hours
TIME = Days
TIME = Months
DAYS = TIME/24
INTR = DAYS
FP = DAYS - INTR
TEST = 24*FP + .5
ADD = TEST
ITIME = TIME
FP = TIME - ITIME
TEST = 24*FP + .5
INTR = ITIME
ADD = TEST
MONTH = MONTH + TIME
DAY = DAY + INTR
HOUR = HOUR + ADD
A
30
A
HOUR < 24
HOUR = 24
DAY = DAY + 1
HOUR = 0
HOUR = HOUR - 24
DAY = DAY + 1
40
DAY < 31
DAY = 31
2.50
DAY = 1
MONTH = MONTH + 1
DAYS = DAY/30
INTR = DAYS
FP = DAYS - INTR
TEST = 30*FP + .5
ADD = TEST
DAY = ADD
MONTH = MONTH + INTR
MONTH < 13
2.A
CLOCK
Compute Elapsed Deployment Time
R. J. Erickson
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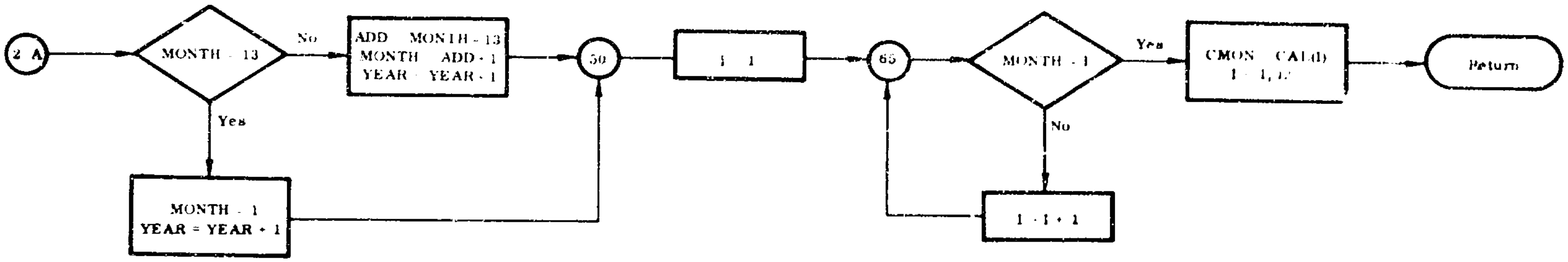
004
1
1 of 2



CLOCK			
Compute Elapsed Deployment Time			
B. J. Erickson		10 Apr 68	
7493	004	1	2 of 2

APPENDIX H

PROGRAM SOURCE CARD DECK FOR
THE INTEGRATED BUOY DEPLOYMENT COST MODEL

(Limited distribution of this Appendix is under separate cover)

APPENDIX I

COMPILATION LISTING FOR THE PROCUREMENT, REPLACEMENT AND MAINTENANCE-COST MODEL

```
C BUOY SYSTEM COSTS FOR PROCUREMENT,REPLACEMENT,MAINTENANCE FOR 40 COMPONENTS
C 25 JUNE 68
C
      DIMENSION CTEST(3),DATE(5),TITLE(16),COMP(4,51),FNBR(51),FLIFE(51)
      DIMENSION COSTN(51),SALV(51),NBR(50),RCOST(50),RPLC(50),NEW(50)
      DIMENSION CLIFE(50)
      TCOST=0.
      PCOST=0.
      KCYCLE=0
      KOMP=0
      READ(1,100)CTEST
  100 FORMAT(3A4)
C
C READ AND WRITE HEADING CARDS
C
  300 READ(1,101)NBRB,FCTR
  101 FORMAT(13X,I3,26X,F3.1)
      IF(FCTR)12,10,12
   10 FCTR=1.0
   12 READ(1,102)DATE
  102 FORMAT(5A4)
      WRITE(3,200)DATE
  200 FORMAT(1H1,15X,5A4,/)
      DO 14 I=1,2
      READ(1,103)TITLE
  103 FORMAT(16A4)
      WRITE(3,201)TITLE
  201 FORMAT(16X,16A4)
   14 CONTINUE
C
C WRITE PAGE HEADINGS
C
      WRITE(3,202)NBRB
  202 FORMAT(/,16X,'AVERAGE ANNUAL REPALCEMENTS FOR',I3,' BUOYS',//)
      WRITE(3,203)
  203 FORMAT(18X,'ITEM',12X,'NBR  LIFE',7X,'COST     SALVAGE   REPLACEMEN
     1TS/YR')
      WRITE(3,204)
  204 FORMAT(33X,'DPLY  (YR)',7X,'EACH      VALUE      NBR      COST')
      IF(KCYCLE)16,16,30
C
C READ COMPONENT CARD LIST MAX OF 40 ITEMS
C
   16 DO 24 J=1,51
      READ(1,104)(COMP(I,J),I=1,4),FNBR(J),FLIFE(J),COSTN(J),SALV(J)
  104 FORMAT(4A4,4X,F4.0,F5.0,2X,F8.0,2X,F6.0)
      IF(COMP(1,J) - CTEST(1))18,30,18
   18 IF(FNBR(J))22,20,22
   20 FNBR(J)=NBRB
   22 NBR(J)=FNBR(J)
      KOMP=KOMP&1
   24 CONTINUE
C
C CARD LIST COMPLETE COMPUTE NBRS AND COST
```

```
C
   30 DO 36 I=1,KOMP
      CLIFE(I)=FLIFE(I)*FCTR
      RCOST(I)=FNBR(I)*(COSTN(I)-SALV(I))/CLIFE(I)
      TCOST=TCOST&RCOST(I)
      PCOST=PCOST&(FNBR(I)*COSTN(I))
      RPLC(I)=FNBR(I)/CLIFE(I)
   36 CONTINUE
      AMAINT=.5*TCOST
      ANOPER=AMAINT & TCOST
C
C WRITE OUTPUT PAGE LINE ITEMS AND GRAND TOTALS
C
      DO 40 J=1,KOMP
      WRITE(3,205)(COMP(I,J),I=1,4),NBR(J),CLIFE(J),COSTN(J),SALV(J),
     1RPLC(J),RCOST(J)
  205 FORMAT(16X,4A4,I5,F6.1,'  $',F9.0,'  $',F7.0,F7.1,'  $',F9.0)
   40 CONTINUE
      WRITE(3,206)PCOST
  206 FORMAT(/,16X,'TOTAL INITIAL PROCUREMENT COST      $',F9.0,'00')
      WRITE(3,207)TCOST
  207 FORMAT(/,16X,'AVERAGE ANNUAL REPLACEMENT COST     $',F9.0,'00')
      WRITE(3,208)AMAINT
  208 FORMAT(/,16X,'AVERAGE ANNUAL MAINTENANCE COST     $',F9.0,'00')
      WRITE(3,209)ANOPER
  209 FORMAT(/,16X,'ANNUAL REPLACEMENT & MAINTENANCE    $',F9.0,'00')
C
C READ OPTION CARD FOR RECY,COMP. CHG IN NAME,NBR,LIFE,COST OR END
C
      READ(1,105)CTYPE
  105 FORMAT(A4)
      IF(CTYPE-CTEST(2))50,52,50
   52 KCYCLE=1
      TCOST=0.
      PCOST=0.
      GO TO 300
   50 IF(CTYPE-CTEST(3))900,54,900
   54 KCYCLE=1
      TCOST=0.
      PCOST=0.
      READ(1,106)NTCHG,(NEW(I),I=1,NTCHG)
  106 FORMAT(I2,26I3/24I3)
      DO 56 K=1,NTCHG
      J=NEW(K)
      READ(1,104)(COMP(I,J),I=1,4),FNBR(J),FLIFE(J),COSTN(J),SALV(J)
      NBR(J)=FNBR(J)
   56 CONTINUE
      GO TO 300
  900 CALL EXIT
      END
```

10/08/68 FORTMAIN 0003

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
TCOST	00D8	PCOST	00DC	KCYCLE	00E0	KOMP	00E4	NBRB	00E8
FCTR	00EC	I	00F0	J	00F4	AMAINT	00F8	ANDPER	00FC
CTYPE	0100	NTCHG	0104	K	0108				

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
CTEST	010C	DATE	0118	TITLE	012C	NBR	016C	PCUST	0234
RPLC	02FC	NEW	03C4	CLIFE	048C	FNBR	0554	FLIFE	0620
COSTN	06EC	SALV	07B8	COMP	0884				

CALLED SUBROUTINES

IJTAAFR IJTACOM IJTFXIT EXIT

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00100	0084	00300	00C0	00101	00E4	00010	0102	00012	010A
00102	012C	00200	0154	00103	0190	00201	0188	00014	01C6
00202	01F4	00203	023C	00204	0290	00016	02D6	00104	039C
00018	0386	00020	03CA	00022	03F2	00024	0424	0003C	0638
00036	0490	00205	058C	0004C	05BA	00206	05E8	00207	063B
00208	0688	00209	06D8	00105	0728	00052	0742	00250	0750
00054	0770	00106	07D4	00056	08BE	00900	08D8		

COMPILATION COMPLETE AMOUNT OF COMMON 00C000 AMOUNT OF CORE 005280 ADDRESS BASE TABLE [illegible]

APPENDIX J

PROGRAM SOURCE CARD DECK FOR

THE PROCUREMENT, REPLACEMENT, AND MAINTENANCE-COST MODEL

(Limited distribution of this Appendix is under separate cover)

APPENDIX K

COMPILATION LISTING FOR

THE 10-YEAR TDP FINANCIAL PLAN COMPUTER PROGRAM

```
C          E. R. SWEETON  TRAVELERS RESEARCH CENTER
C
C          THIS ROUTINE COMPUTES THE SUMMARY OF ALL FINANCIAL EXPENDITURES
C          FOR THE TEN YEAR PLAN, NATIONAL DATA BUOY SYSTEM.
C          INPUT REQUIRED IS AS FOLLOWS-
C          1. MAXBIN (I5)
C               NUMBER OF DIFFERENT CATEGORIES COSTS ARE ALLOCATED TO.
C          1A. BNH(I,J) (20A4)
C               TITLES IDENTIFYING EACH OF THE ABOVE CATEGORIES.
C          2. NMJ (I5)
C               NUMBER OF MAJOR ACTIVITIES TO BE INCLUDED IN THIS RUN.
C          3. MJCTV (20A4)
C               ONE OF THE ABOVE NUMBER OF MAJOR ACTIVITIES.
C          4. NSB (I5)
C               NUMBER OF SUB ACTIVITIES INCLUDED IN ABOVE MAJOR ACTIVITY.
C          5. MNCTV (20A4)
C               ONE OF THE ABOVE NUMBER OF SUB ACTIVITIES.
C          6. NSWCH (40I2)
C               THE VECTOR INDICATING WHICH CATEGORIES THE FOLLOWING COSTS
C               ARE TO BE ALLOCATED TO.  1 INDICATES ALLOCATION, BLANK OR
C               ZERO CAUSES CATEGORY TO BE BYPASSED.
C          7. KPDS (I5)
C               NUMBER OF COST PERIODS INCLUDED IN ABOVE SUB ACTIVITY.
C          7A. CPH(I) (10A4)
C               TITLE IDENTIFYING ONE OF THE ABOVE COST PERIODS.
C          8. MSTART, MSTOP, TDOL (2I5,F12.0)
C               THE BEGINNING AND ENDING MONTH DEFINING ONE OF THE ABOVE
C               COST PERIODS AND THE TOTAL DOLLARS SPENT IN THIS PERIOD.
C               IF PERIOD FUNDING IS TO BE LEFT OPEN FOR FUTURE CONSIDER-
C               ATION, DO NOT ENTER ZERO FOR TOTAL DOLLARS. NONSENSICAL
C               AMOUNT MUST BE USED (IE., .0001).
C          9. SCOST(I) (6F12.0)
C               THE MONTHLY COST FOR EACH OF THE MONTHS DEFINED IN THE
C               ABOVE TIME PERIODS. USED ONLY IF TDOL IN (8.) IS ZERO.
C          DECK SETUP NOTES-
C               (3.) THRU (9.) ARE REPEATED THE NUMBER OF TIMES STATED IN
C               (2.), (5.) THRU (9.) THE NUMBER STATED IN (4.) AND (8.)
C               AND (9.) THE NUMBER STATED IN (7.).
C
      DIMENSION BIN(27,120),TCOST(120),QTR(27,40),NSWCH(27),MJCTV(20),
     1MNCTV(20),BNH(20,27),SCOST(120),CPH(10),ISCOST(120),IQTR(4),
     2BAR(15,4),TYR(10),NTYR(4)
C
      READ(1,10)MAXBIN,IBR
   10 FORMAT(16I5)
      READ(1,17)((BNH(I,J),I=1,20),J=1,MAXBIN)
      WRITE(3,15)(J,(BNH(I,J),I=1,20),J=1,MAXBIN)
   15 FORMAT(1H117X28HCOST VECTOR DEFINITION TABLE//8X8HCATEGORY32X
     110HDEFINITION//(I12,1X20A4))
C         CLEAR BINS
   25 DO 30 I=1,27
      DO 30 J=1,120
      BIN(I,J)=0.
   30 CONTINUE
```

```
      READ(1,10)NMJ
C         READ MAJOR ACTIVITIES
      DO 490 IMJ=1,NMJ
      READ(1,17)MJCTV
   17 FORMAT(20A4)
      READ(1,10)NSB
C         READ SUB ACTIVITIES
      DO 215 ISB=1,NSB
   35 READ(1,17)MNCTV
C         CLEAR COST MONTHS, READ COST VECTOR
   40 DO 45 I=1,120
      TCOST(I)=0.
   45 CONTINUE
      READ(1,50)(NSWCH(I),I=1,MAXBIN)
   50 FORMAT(40I2)
      WRITE(3,55)MJCTV,MNCTV
   55 FORMAT(1H17X16HMAJOR ACTIVITY- 20A4,39X5HINPUT//8X16H  SUB-ACTIVIT
     1Y- 20A ,///11X2HYR10X7HPROGRAM)
C         READ COST PERIODS
      READ(1,10)KPDS
      ILNS=6
      DO 175 K=1,KPDS
      READ(1,60)CPH,MSTART,MSTOP,TDOL
   60 FORMAT(10A4/2I5,F12.0)
      ILNS=ILNS+5
      IF(ILNS-60)63,63,61
   61 WRITE(3,62)
   62 FORMAT(1H1)
      ILNS=5
   63 WRITE(3,65)CPH,MSTART,MSTOP
   65 FORMAT(1H010X10A4,2X13HSTART MONTH =I6/54X12HSTOP MONTH =I6)
      IF(TDOL)70,90,70
   70 CPM=TDOL/FLOAT(MSTOP-MSTART+1)
      DO 80 I=MSTART,MSTOP
      TCOST(I)=CPM+TCOST(I)
   80 CONTINUE
      ITDOL=(IFIX(TDOL)+500)/1000
      ICPM=(IFIX(CPM)+500)/1000
  120 WRITE(3,130)ITDOL,ICPM
  130 FORMAT(57X10HFUNDING =$I5,1HK/47X20HAVG FUNDING/MONTH =$I5,1HK)
      GO TO 175
   90 READ(1,95)(SCOST(I),I=MSTART,MSTOP)
   95 FORMAT(6F12.0)
      DO 140 I=MSTART,MSTOP
      TDOL=TDOL+SCOST(I)
  140 CONTINUE
      ITDOL=(IFIX(TDOL)+500)/1000
      DO 142 I=MSTART,MSTOP
      ISCOST(I)=(IFIX(SCOST(I))+500)/1000
  142 CONTINUE
      WRITE(3,150)ITDOL,(ISCOST(I),I=MSTART,MSTOP)
  150 FORMAT(57X10HFUNDING =$I5,1HK/(51X16HFUNDING/MONTH =$I5,1HK))
      DO 173 I=MSTART,MSTOP
      TCOST(I)=SCOST(I)+TCOST(I)
  173 CONTINUE
```

```
  178 CONTINUE
      ILNS=ILNS+(MAXBIN/15)*4+4
      IF(ILNS-60)1752,1752,1750
 1750 WRITE(3,1751)
 1751 FORMAT(1H1)
 1752 WRITE(3,176)
  176 FORMAT(1H010X24HCOST ALLOCATION VECTOR -//)
      ILNS=MAXBIN/15
      IP=MOD(MAXBIN,15)
      IF(ILNS)1790,1790,177
  177 DO 179 L=1,ILNS
      IU=L*15
      IL=IU-14
      WRITE(3,178)(I,I=IL,IU),(NSWCH(I),I=IL,IU)
  178 FORMAT(15X10HCATEGORIES15I3/25X15I3//)
  179 CONTINUE
 1790 IF(IP)180,180,1791
 1791 IL=ILNS*15+1
      IU=IL+IP-1
      WRITE(3,1792)(I,I=IL,IU)
 1792 FORMAT(15X10HCATEGORIES15I3)
      WRITE(3,1793)(NSWCH(I),I=IL,IU)
 1793 FORMAT(25X15I3)
C          ALLOCATE COST
  180 DO 210 I=1,MAXBIN
      IF(NSWCH(I))190,210,190
  190 DO 200 K=1,120
      BIN(I,K)=BIN(I,K)+TCOST(K)
  200 CONTINUE
  210 CONTINUE
  215 CONTINUE
  490 CONTINUE
C          COMPUTE QUARTERS
  220 DO 250 I=1,MAXBIN
      KTR=0
      DO 240 J=1,120,3
      KTR=KTR+1
      QTR(I,KTR)=0.
      LN=J+2
      DO 230 K=J,LN
      QTR(I,KTR)=QTR(I,KTR)+BIN(I,K)
  230 CONTINUE
  240 CONTINUE
  250 CONTINUE
C          WRITE OUTPUT
      DO 300 NB=1,MAXBIN
      WRITE(3,260)(BNH(LT,NB),LT=1,20)
  260 FORMAT(1H120A4)
      NY=0
      DO 2610 I=1,40,4
      NY=NY+1
      LN=I+3
      TYR(NY)=0.
      DO 2600 K=I,LN
      TYR(NY)=TYR(NY)+QTR(NB,K)
```

```
2600 CONTINUE
2610 CONTINUE
     IF(IBR)2615,255,2615
2615 QMX=TYR(1)
     DO 2630 K=2,10
     IF(TYR(K)-QMX)2630,2630,2620
2620 QMX=TYR(K)
2630 CONTINUE
     SCL=1200.
     DO 2650 I=1,5
     SCL=10.*SCL
     IF(QMX-SCL)2640,2640,2650
2640 ISCL=I
     GO TO 2660
2650 CONTINUE
     ISCL=5
2660 NSCL=20*(10**ISCL)
     GO TO 267
 255 QMX=QTR(NB,1)
     DO 262 K=2,40
     IF(QTR(NB,K)-QMX)262,262,261
 261 QMX=QTR(NB,K)
 262 CONTINUE
     SCL=1200.
     DO 264 I=1,5
     SCL=10.*SCL
     IF(QMX-SCL)263,263,264
 263 ISCL=I
     GO TO 265
 264 CONTINUE
     ISCL=5
 265 NSCL=20*(10**ISCL)
 267 GO TO (2710,2720,2730,2740,2750),ISCL
2710 WRITE(3,2715)
2715 FORMAT(97X12H$  THOUSANDS)
     GO TO 2760
2720 WRITE(3,2725)
2725 FORMAT(96X15H$  10 THOUSANDS)
     GO TO 2760
2730 WRITE(3,2735)
2735 FORMAT(95X16H$  100 THOUSANDS)
     GO TO 2760
2740 WRITE(3,2745)
2745 FORMAT(98X11H$  MILLIONS)
     GO TO 2760
2750 WRITE(3,2755)
2755 FORMAT(96X14H$  10 MILLIONS)
2760 WRITE(3,2765)
2765 FORMAT(31X5HTOTAL12X9HQUARTERLY15X61HC     1     2     3     4     5
    1 6     7     8     9    10    11    12/23X4HYEAR4X4H($K)3X7HQUARTER6X4H(
    2$K)17X61H.     .     .     .     .     .     .     .     .     .     .     .
    3    .)
     NR=1968
     NY=0
     DO 290 I=1,40,4
```

```
      NY=NY+1
      NR=NR+1
      LN=I+3
      DO 270 K=I,LN
      L=K-I+1
      IQTR(L)=IFIX(QTR(NB,K))
  270 CONTINUE
      IF(IRR)2770,2790,2770
 2770 NTYR(1)=IFIX(TYR(NY))
      DO 2780 K=2,4
      NTYR(K)=NTYR(1)
 2780 CONTINUE
      CALL CMPBAR (NTYR,BAR,NSCL)
      GO TO 2795
 2790 CALL CMPBAR (IQTR,BAR,NSCL)
 2795 ITYR=(IFIX(TYR(NY))+500)/1000
      DO 271 K=1,4
      IQTR(K)=(IQTR(K)+500)/1000
  271 CONTINUE
      WRITE(3,272)NR,ITYR,IQTR(1),(BAR(M,1),M=1,15)
  272 FORMAT(1H022XI4,I8,6X1H1I13,17X1H.15A4)
      WRITE(3,275)(L,IQTR(L),(BAR(M,L),M=1,15),L=2,4)
  275 FORMAT(41XI1,I13,17X1H.15A4)
  290 CONTINUE
C        COMPUTE GRAND TOTAL
      GT=0
      DO 291 I=1,40
      GT=GT+(QTR(NR,I))
  291 CONTINUE
      IGT=(IFIX(GT)+500)/1000
      WRITE(3,292)
  292 FORMAT(1H071X61H.     .     .     .     .     .     .     .     .
     1.     .     .)
      WRITE(3,281)IGT
  281 FORMAT(40X9HTOTAL    $I6,17X61H0     1     2     3     4     5     6     7
     1     8     9    10    11    12)
  300 CONTINUE
      STOP
      END
```

10/08/68 FORTMAIN 0006

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
MAXBIN	0214	IBR	0218	I	021C	J	0220	NPJ	0224
INJ	0228	NSB	022C	ISB	0230	KPDS	0234	ILNS	0238
K	023C	MSTART	0240	MSTOP	0244	TDOL	0248	CPN	024C
ITDOL	0250	ICPN	0254	IP	0258	L	025C	IU	026C
IL	0264	KTR	0268	LN	026C	NB	0270	LT	0274
NY	0278	QMX	027C	SCL	0280	ISCL	0284	NSCL	0288
NR	028C	ITYR	0290	M	0294	GT	0298	IGT	029C

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IQTR	02A0	NTYR	02B0	CPH	02C0	TYR	02E8	PJCTV	0310
MNCTV	0360	NSMCH	0380	BAR	041C	TCOST	050C	SCOST	05FC
ISCOST	08CC	BNH	0AAC	QTR	131C	BIN	23FC		

CALLED SUBROUTINES

IJTAPST IJTAAFR IJTACOM IJTAIXI IJTMODI MOD CMPRAR

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00010	009C	00015	0190	00025	01E4	00030	0214	00017	0238
00035	02B4	00040	02D8	00045	02F4	00050	0350	00055	0396
00060	0444	00061	0474	00062	048C	00063	04A0	00065	04D4
00070	051B	00080	0566	00120	05D6	00130	05FC	00090	063C
00095	0688	00140	06B2	00142	0736	00150	079C	00173	07FC
00175	0804	01750	0848	01751	0860	01752	086C	00176	0896
00177	08D8	00178	0970	00179	0994	01790	09A8	01791	09B4
01792	0A19	01793	0A7B	0018C	0A86	00190	0AA2	00200	0AB4
00210	0AE9	00215	0AFC	0049C	0B10	00220	0B24	00230	0B36
00240	0BCA	00250	0BDE	0026C	0C54	02600	0CD2	02610	0CEA
02615	0D06	02620	0D2E	0263C	0D3E	02640	0D86	02650	0DB4
02660	0D80	00255	0DCE	00261	0E10	00262	0E2E	00263	0E74
00264	0E84	00265	0EAC	00267	0EB8	02710	0EE4	02715	0EFC
02720	0F14	02725	0F34	02730	0F56	02735	0F70	02740	0F92
02745	0FAC	02750	0FCA	02755	0FE4	02760	0FFE	02765	1018
00270	1174	02770	1194	02780	1106	02790	11FE	02795	122C
00271	126E	00272	12EC	00275	13A4	00290	13BC	00291	1402
00292	145C	00281	14C0	00300	1518				

COMPILATION COMPLETE AMOUNT OF COMMON 000000 AMOUNT OF CORE 027688 ADDRESS BASE TABLE 1518

// EXEC ASSEMBLY

EXTERNAL SYMBOL DICTIONARY

SYMBOL	TYPE	ID	ADDR	LENGTH	LD ID
CMPBAR	SD	01	000000	0000A4	

```
LOC  OBJECT CODE    ADDR1 ADDR2  STMT   SOURCE STATEMENT                                        F05S FL3-1 10/20/68
                                   2 *          BASE REGISTER R2
                                   3            PRINT ON,GEN,DATA
000000                             4 CMPBAR     START 0
                                   5            SAVE (14,12)
                                   6+* 360N-CL-453 SAVE     CHANGE LEVEL 3-0
000000 90EC D00C          0000C    7+           STM    14,12,12+4*(14+2-(14+2)/16*16)(13)
000004 0520                        8            BALR   R2,0
000006                             9            USING  *,R2
000006 5871 0000          0000C   10            L      R7,0(R1) R7 HAS ADD OF QUARTER ARRAY
00000A 5861 0004          00004   11            L      R6,4(R1) R6 HAS ADD OF BAR ARRAY
00000E 5851 0008          00008   12            L      R5,8(R1) R5 HAS ADD OF SCALE FACTOR
000012 58A5 0000          00000   13            L      R10,0(R5) R10 HAS SCALE FACTOR
000016 8EA0 0020          00020   14            SRDA   R10,32(0)
00001A 5DA0 209A          00090   15            D      R10,=F'2'
00001E 58A5 0000          00000   16            L      R10,0(R5)
000022 5880 208E          00094   17            L      R8,=F'4'
000026 1897                       18            LR     R9,R7
000028 5A90 2092          00098   19            A      R9,=F'12'
00002C 1836                       20 QTRLP      LR     R3,R6
00002E 9240 3000    00000         21            MVI    0(R3),X'40'
000032 D23A 3001 3000 00001 00000 22            MVC    1(59,R3),0(R3)
000038 5847 0000          0000C   23            L      R4,0(R7) R4 HAS QUARTER
00003C 1A4B                       24            AR     R4,R11 ROUND UP TO NEAREST HALF SCALE
00003E 8E40 0020          00020   25            SRDA   R4,32(0)
000042 1D4A                       26            DR     R4,R10
000044 1255                       27            LTR    R5,R5
000046 4780 2060          00066   28            BZ     NXBR
00004A 1845                       29            LR     R4,R5
00004C 5B40 2096          0009C   30            S      R4,=F'60'
000050 4720 206E          00074   31            BP     OFFSCL QUARTER GREATER THAN 12M
000054 5840 209A          000A0   32            L      R4,=F'1'
000058 1A53                       33            AR     R5,R3
00005A 5B50 209A          000A0   34            S      R5,=F'1'
00005E 925C 3000    00000         35 BLDBAR     MVI    0(R3),X'5C'
000062 8734 2058          0005E   36            BXLE   R3,R4,BLDBAR
000066 5A60 2096          0009C   37 NXBR       A      R6,=F'60'
00006A 8778 2026          0002C   38            BXLE   R7,R8,QTRLP
                                  39 RETURN     RETURN (14,12)
                                  40+* 360N-CL-453 RETURN   CHANGE LEVEL 3-0
00006E 98EC D00C          0000C   41+RETURN     LM     14,12,12+4*(14+2-(14+2)/16*16)(13)
000072 07FE                       42+           BR     14
000074 D20A 3000 2078 00000 0007E 43 OFFSCL     MVC    0(11,R3),SCLMSG
00007A 47F0 2060          00066   44            B      NXBR
```

```
BAR CHART CONSTRUCTION                                                                      PAGE    2

 LOC  OBJECT CODE     ADDR1 ADDR2  STMT    SOURCE STATEMENT                                FDOS CL3-1 12/28/6

000001                               46 R1        EQU    1
000002                               47 R2        EQU    2
000003                               48 R3        EQU    3
000004                               49 R4        EQU    4
000005                               50 R5        EQU    5
000006                               51 R6        EQU    6
000007                               52 R7        EQU    7
000008                               53 R8        EQU    8
000009                               54 R9        EQU    9
00000A                               55 R10       EQU    10
00000B                               56 R11       EQU    11
00007F 4DD6C6C640E2C3C1              57 SCLMSG    DC     CL11'(OFF SCALE)'
000086 D3C55D
000090                               58           LTORG
000090 00000002                      59                  =F'2'
000094 00000004                      60                  =F'4'
000098 0000000C                      61                  =F'12'
00009C 0000003C                      62                  =F'60'
0000A0 00000001                      63                  =F'1'
                                     64           END
```

SYMBOL	LEN	VALUE	DEFN	REFERENCES							
BLDBAR	00004	00005F	00035	0036							
CMPBAR	00001	000000	00004								
NXBR	00004	000066	00037	0028	0044						
OFFSCL	00006	000074	00043	0031							
OTRIP	00002	00002C	00020	0038							
RETURN	00004	00006E	00041								
R1	00001	000001	00046	0010	0011	0012					
R10	00001	00000A	00055	0013	0014	0015	0016	0026			
R11	00001	00000B	00056	0024							
R2	00001	000002	00047	0009	0009						
R3	00001	000003	00048	0020	0021	0022	0022	0033	0035	0036	0043
R4	00001	000004	00049	0023	0024	0025	0026	0029	0030	0032	0036
R5	00001	000005	00050	0012	0013	0016	0027	0027	0029	0033	0034
R6	00001	000006	00051	0011	0020	0037					
R7	00001	000007	00052	0010	0018	0023	0038				
R8	00001	000008	00053	0017	0038						
R9	00001	000009	00054	0018	0019						
SCLMSG	00011	00007E	00057	0043							

NO STATEMENTS FLAGGED IN THIS ASSEMBLY

APPENDIX L

PROGRAM SOURCE CARD DECK FOR THE 10-YEAR TDP FINANCIAL PLAN COMPUTER PROGRAM

(Limited distribution of this Appendix is under separate cover)

APPENDIX M

BUOY COMPONENT CHARACTERISTICS DATA CARDS

(Limited distribution of this Appendix is under separate cover)

APPENDIX N

COMPILATION LISTING FOR THE BUOY COMPONENT DATA CARD-TO-TAPE PROGRAM

```
C PROGRAM ALPINE  TO READ BUOY COMPONENT DATA CARDS ONTO TAPE
C EACH COMPONENT ENTRY HAS FROM 1 TO 6 CARDS TO SPECIFY ITS CHARACTERISTICS
C EACH COMPONENT ENTRY WILL GENERATE 1 OR 2 RECORDS ON TAPE
C H.J. ERICKSON,TRC, 15 OCT 1968
C
C FILL IAK,IBK(BLANK) ARRAYS FROM 6 BLANK CARDS
C
      DIMENSION IAK(71),IBK(75),ICD(71),IBD(75),IT1(71),IT2(75)
      READ(1,1)(IAK(I),I=1,24)
    1 FORMAT(I2,I3,A4,I4,I1,A2,2(A4),3A4,2A4,A4,2A4,2(A2),A3,2(2A4),A1)
      READ(1,2)(IAK(I),I=25,47)
    2 FORMAT(2A4,A2,A3,2A4,A3,A4,2(A2,A4),2(A4),A2,2A4,3(A4),A2,2A4)
      READ(1,3)(IAK(I),I=48,71)
    3 FORMAT(2A4,2(A2),2(A4),2(A4,A2),2(2A4,A2),A2,3(A4),A3,2(A4),A3)
      READ(1,4)(IBK(I),I=1,26)
    4 FORMAT(A3,3(A4),A2,A1,A4,A3,A4,2(A3),2A4,A1,2(A4),2(A3),A1,A4,A3,
     1A4,2(A1,A4))
      READ(1,5)(IBK(I),I=27,50)
    5 FORMAT(A4,A3,2(A4),A3,A4,A1,A4,2(A3),A2,A4,A1,2(A4),A3,A4,2A4,
     12(A4),A2,A4,A3)
      READ(1,6)(IBK(I),I=51,75)
    6 FORMAT(3(A3),A4,2A4,A1,A4,2(2A4),4(A3),2(A1,A4),A2,2A4,A2,A4)
C
C OUTPUT TAPE ON 11
      REWIND 11
      KREC=0
      KCARD=0
      KCOMP=0
C
C READ FIRST CARD OF SET  INTO ICD(CARD) ARRAY
C
  200 READ(1,1)(ICD(I),I=1,24)
      IF(ICD(5)-6)10,10,205
   10 NCRD=ICD(5)
      IF(KCARD)14,12,14
   12 KCD=ICD(1)
      KCOMP=KCOMP & 1
   14 IF(ICD(4)-9999)16,900,16
   16 GO TO(20,30,40,40,40,40),NCRD
C
C ONE CARD FOR THIS COMPONENT ENTRY
C
   20 DO 22 J=1,24
   22 IT1(J)=ICD(J)
      DO 24 J=25,71
   24 IT1(J)=IAK(J)
      KCARD=KCARD & ICD(5)
      GO TO 100
C
C TWO CARDS FOR THIS COMPONENT ENTRY
C
   30 READ(1,2)(ICD(I),I=25,47)
      DO 32 J=1,47
   32 IT1(J)=ICD(J)
```

```
      DO 34 J=48,71
   34 IT1(J)=IAK(J)
      KCARD=KCARD & ICD(5)
      GO TO 100
C
C THREE OR MORE CARDS FOR THIS COMPONENT ENTRY
C
   40 READ(1,2)(ICD(I),I=25,47)
      READ(1,3)(ICD(I),I=48,71)
      DO 42 J=1,71
   42 IT1(J)=ICD(J)
      KCARD=KCARD & ICD(5)
      IF(ICD(5)-4)100,50,44
   44 IF(ICD(5)-6)60,70,70
C
C FOUR CARDS FOR THIS COMPONENT ENTRY
C
   50 READ(1,4)(IRD(I),I=1,26)
      DO 52 J=1,26
   52 IT2(J)=IRD(J)
      DO 54 J=27,75
   54 IT2(J)=IBK(J)
      GO TO 100
C
C FIVE CARDS FOR THIS COMPONENT ENTRY
C
   60 READ(1,4)(IRD(I),I=1,26)
      READ(1,5)(IRD(I),I=27,50)
      DO 62 J=1,50
   62 IT2(J)=IRD(J)
      DO 64 J=51,75
   64 IT2(J)=IBK(J)
      GO TO 100
C
C SIX CARDS FOR THIS COMPONENT ENTRY
C
   70 READ(1,4)(IRD(I),I=1,26)
      READ(1,5)(IRD(I),I=27,50)
      READ(1,6)(IRD(I),I=51,75)
      DO 72 J=1,75
   72 IT2(J)=IRD(J)
C
C WRITE ONE RECORD ON TAPE 11,ICD(5)=1,2,3
C
  100 WRITE(11,7)IT1
    7 FORMAT(I2,I3,A4,I4,I1,A2,2(A4),3A4,2A4,A4,2A4,2(A2),A3,2(2A4),A1,
     12A4,A2,A3,2A4,A3,A4,2(A2,A4),2(A4),A2,2A4,3(A4),A2,2A4,2A4,2(A2),
     22(A4),2(A4,A2),2(2A4,A2),A2,3(A4),A3,2(A4),A3)
      KREC=KREC & 1
      IF(KCD-IT1(1))102,104,102
  102 KCOMP=KCOMP & 1
      KCD=IT1(1)
  104 IF(ICD(5)-3)106,106,108
  106 GO TO 200
C
```

```
C WRITE TWO RECORDS ON TAPE 11,ICD(5)=4,5,6
C
  108 WRITE(11,8)IT2
    8 FORMAT(A3,3(A4),A2,A1,A4,A3,A4,2(A3),2A4,A1,2(A4),2(A3),A1,A4,A3,
     1A4,2(A1,A4),A4,A3,2(A4),A3,A4,A1,A4,2(A3),A2,A4,A1,2(A4),A3,A4,
     22A4,2(A4),A2,A4,A3,3(A3),A4,2A4,A1,A4,2(2A4),4(A3),2(A1,A4),A2,
     32A4,A2,A4)
      KREC=KREC & 1
      GO TO 200
C
C END OF DATA CARDS
C
  900 DO 901 J=1,24
  901 IT1(J)=ICD(J)
      DO 902 J=25,71
  902 IT1(J)=IAK(J)
      WRITE(11,7)IT1
      KREC=KREC & 1
      END FILE 11
      REWIND 11
      WRITE(3,500)KCARD,KCOMP,KREC
  500 FORMAT(1H1,/,' TOTAL CARDS PROCESSED ='I5,5X,'TOTAL COMPONENTS PRO
     1CESSED ='I3,5X,'TOTAL RECORDS ON TAPE ='I5,/,' LAST RECORD ON TAPE
     2 CONTAINS ONLY 99990 ENTRY')
      GO TO 999
C
C NBR OF CARDS TO PROCESS EXCEEDS 6
C
  905 WRITE(3,501)
  501 FORMAT(1H1,/,' THE FOLLOWING CARD TYPE 1 IS IN ERROR',//)
      WRITE(3,502)(ICD(I),I=1,5)
  502 FORMAT(1X,I3,2X,I3,2X,A4,2X,I4,2X,I1)
      REWIND 11
  999 CALL EXIT
      END
```

10/23/68 FORTMAIN 0004

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	0130	KREC	0134	KCARD	0138	KCOMP	013C	NCRF	0140
KCD	0144	J	0148						

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IAK	014C	ICD	0268	IT1	0384	IBK	04A0	IRD	05CC
IT2	06E8								

CALLED SUBROUTINES

IJTARRF IJTAAFR IJTACOM IJTEXIT EXIT

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00001	0088	00002	0130	00003	01A8	00004	0220	00005	0240
00006	031C	00200	0370	00010	03C4	00012	0308	00014	03EC
00016	03FC	00020	042A	00022	0432	00024	045F	00030	0494
00032	04E0	00034	050C	00040	0542	00042	05D0	00044	0516
00050	062C	00052	0678	00054	06A4	00060	06CE	00062	075C
00064	0788	00070	07B2	00072	0880	00100	08A4	00067	08C4
00102	0972	00104	0986	00106	0996	00108	099C	00068	098C
00900	0A6C	00901	0A74	00902	0AA0	00500	0B28	00905	0BC6
00501	0BDC	00502	0C54	00999	0C78				

COMPILATION COMPLETE AMOUNT OF COMMON 000000 AMOUNT OF CORE 005288 ADDRESS BASE TABLE 0C50

N-6

APPENDIX O

SOURCE CARD DECK FOR

THE BUOY COMPONENT DATA CARD-TO-TAPE PROGRAM

(Limited distribution of this Appendix is under separate cover)

APPENDIX P

COMPILATION LISTING FOR

THE BUOY COMPONENT DATA FILE RETRIEVAL PROGRAM

```
C PROGRAM ALPINE PRINT  PRINT OUT BUOY COMPONENT DATA
C EACH COMPONENT WILL HAVE 1 OR 2 PAGES WITH 42 OR 84 CHARACTERISTICS
C R.J. ERICKSON,TRC, 18 OCT 1968
C
      DIMENSION COMP(8,32),IWRD(71,7),LWRD(75,7),TITLE1(20),TITLE2(20)
C
C READ COMPONENT NAME LIST
C
      DO 10 J=1,32
   10 READ(1,1)(COMP(I,J),I=1,8)
    1 FORMAT(7X,8A4)
C
C READ 2 TITLE CARDS
C
      READ(1,2)TITLE1
      READ(1,2)TITLE2
    2 FORMAT(20A4)
C
C SET TAPE 11, SET COUNTERS,READ RECORD,MAKE TESTS
C
      REWIND 11
      MAXC=7
      KEND=0
      NPAGE=0
  202 KPAGE=0
      NCP=-0
  201 J=0
  200 J=J&1
      IF(J-MAXC)12,12,300
   12 READ(11,3)(IWRD(I,J),I=1,71)
    3 FORMAT(I2,I3,A4,I4,I1,A2,2(A4),3A4,2A4,A4,2A4,2(A2),A3,2(2A4),A1,
     12A4,A2,A3,2A4,A3,A4,2(A2,A4),2(A4),A2,2A4,3(A4),A2,2A4,2A4,2(A2),
     22(A4),2(A4,A2),2(2A4,A2),A2,3(A4),A3,2(A4),A3)
C
      IF(IWRD(4,J)-9999)14,400,14
   14 IF(NCP)16,16,18
   16 NCP=IWRD(1,J)
   18 IF(IWRD(1,J)-NCP)30,20,30
   20 IF(IWRD(5,J)-3)200,200,22
   22 IF(KPAGE)24,24,26
   24 KPAGE=1
C
C COMPONENT HAS TWO RECS FOR EACH ENTRY
C
   26 READ(11,4)(LWRD(I,J),I=1,75)
    4 FORMAT(A3,3(A4),A2,A1,A4,A3,A4,2(A3),2A4,A1,2(A4),2(A3),A1,A4,A3,
     1A4,2(A1,A4),A4,A3,2(A4),A3,A4,A1,A4,2(A3),A2,A4,A1,2(A4),A3,A4,
     22A4,2(A4),A2,A4,A3,3(A3),A4,2A4,A1,A4,2(2A4),4(A3),2(A1,A4),A2,
     32A4,A2,A4)
      GO TO 200
C
  400 IF(J-1)401,401,402
  401 GO TO 900
  402 KEND=9999
```

```
      GO TO 300
C
C COMPONENT CHANGED,WRITE OUTPUT PAGE(S)
C
   30 BACKSPACE 11
      IF(J-1)31,31,300
   31 GO TO 202
C
C OUTPUT ARRAY FILLED,WRITE OUTPUT PAGE(S)
C
  300 J=J-1
      NPAGE=NPAGE & 1
      WRITE(3,5)TITLE1,NPAGE
    5 FORMAT(1H1,/,1X,20A4,26X,'PAGE 'I4)
      WRITE(3,6)TITLE2
    6 FORMAT(1X,20A4,/)
      WRITE(3,7)(COMP(I,NCP),I=1,8)
    7 FORMAT(36X,'COMPONENT = '8A4,//)
C
C WRITE 35 CHARACTERISTICS FOR TOP HALF PAGE THIS COMP.
C
      WRITE(3,32)(IWRD(3,K),K=1,J)
   32 FORMAT('            BUOY ID NUMBER *',7(8X,A4,' *'))
      WRITE(3,33)(IWRD(4,K),K=1,J)
   33 FORMAT('   YEAR/MONTH AVAILABLE *',7(8X,I4,' *'))
      WRITE(3,34)(IWRD(8,K),K=1,J)
   34 FORMAT('              MANUFACTURER *',7(8X,A4,' *'))
      WRITE(3,35)((IWRD(I,K),I=9,11),K=1,J)
   35 FORMAT('              MODEL NUMBER *',7(3A4,' *'))
      WRITE(3,36)((IWRD(I,K),I=12,13),K=1,J)
   36 FORMAT('            COST, DOLLARS *',7(4X,2A4,' *'))
      WRITE(3,37)(IWRD(14,K),K=1,J)
   37 FORMAT('0              RELIABILITY *',7(8X,A4,' *'))
      WRITE(3,38)((IWRD(I,K),I=15,17),K=1,J)
   38 FORMAT('                          TYPE *',7(2X,2A4,A2,' *'))
      WRITE(3,39)((IWRD(I,K),I=18,19),K=1,J)
   39 FORMAT('              RANGE, LOW *',7(7X,A2,A3,' *'))
      WRITE(3,40)((IWRD(I,K),I=20,21),K=1,J)
   40 FORMAT('            RANGE, HIGH *',7(4X,2A4,' *'))
      WRITE(3,41)((IWRD(I,K),I=22,24),K=1,J)
   41 FORMAT('                   ACCURACY *',7(3X,2A4,A1,' *'))
      WRITE(3,42)((IWRD(I,K),I=25,27),K=1,J)
   42 FORMAT(' OUTPUT CHARACTERISTICS *',7(2X,2A4,A2,' *'))
      WRITE(3,43)((IWRD(I,K),I=28,30),K=1,J)
   43 FORMAT('0                          SIZE *',7(1X,A3,2A4,' *'))
      WRITE(3,44)((IWRD(I,K),I=31,32),K=1,J)
   44 FORMAT('                        WEIGHT *',7(5X,A3,A4,' *'))
      WRITE(3,45)((IWRD(I,K),I=33,34),K=1,J)
   45 FORMAT('                   DIAMETER *',7(6X,A2,A4,' *'))
      WRITE(3,46)((IWRD(I,K),I=35,36),K=1,J)
   46 FORMAT('                        LENGTH *',7(6X,A2,A4,' *'))
      WRITE(3,47)(IWRD(37,K),K=1,J)
   47 FORMAT('                        HEIGHT *',7(8X,A4,' *'))
      WRITE(3,48)(IWRD(38,K),K=1,J)
   48 FORMAT('                          WIDTH *',7(8X,A4,' *'))
```

```
      WRITE(3,49)((IWRD(I,K),I=39,41),K=1,J)
   49 FORMAT('0           DEPTH LIMITS *',7(2X,A2,2A4,' *'))
      WRITE(3,50)(IWRD(42,K),K=1,J)
   50 FORMAT('           SURVIVABILITY *',7(8X,A4,' *'))
      WRITE(3,51)(IWRD(43,K),K=1,J)
   51 FORMAT('0           CONSTRUCTION *',7(8X,A4,' *'))
      WRITE(3,52)(IWRD(44,K),K=1,J)
   52 FORMAT('                MATERIAL *',7(8X,A4,' *'))
      WRITE(3,53)((IWRD(I,K),I=45,47),K=1,J)
   53 FORMAT('                CAPACITY *',7(2X,A2,2A4,' *'))
      WRITE(3,54)((IWRD(I,K),I=48,50),K=1,J)
   54 FORMAT('0              CODE TYPE *',7(2X,2A4,A2,' *'))
      WRITE(3,55)((IWRD(I,K),I=51,52),K=1,J)
   55 FORMAT('         ACCURACY, SPEED *',7(6X,A2,A4,' *'))
      WRITE(3,56)(IWRD(53,K),K=1,J)
   56 FORMAT('     ACCURACY, DIRECTION *',7(8X,A4,' *'))
      WRITE(3,57)((IWRD(I,K),I=54,55),K=1,J)
   57 FORMAT('             TYPE, SPEED *',7(6X,A4,A2,' *'))
      WRITE(3,58)((IWRD(I,K),I=56,57),K=1,J)
   58 FORMAT('         TYPE, DIRECTION *',7(6X,A4,A2,' *'))
      WRITE(3,59)((IWRD(I,K),I=58,60),K=1,J)
   59 FORMAT('           OUTPUT, SPEED *',7(2X,2A4,A2,' *'))
      WRITE(3,60)((IWRD(I,K),I=61,63),K=1,J)
   60 FORMAT('       OUTPUT, DIRECTION *',7(2X,2A4,A2,' *'))
      WRITE(3,61)((IWRD(I,K),I=64,65),K=1,J)
   61 FORMAT('0     POWER REQUIREMENTS *',7(6X,A2,A4,' *'))
      WRITE(3,62)(IWRD(66,K),K=1,J)
   62 FORMAT('     BIOLOGICAL IMMUNITY *',7(8X,A4,' *'))
      WRITE(3,63)((IWRD(I,K),I=67,68),K=1,J)
   63 FORMAT('       BREAKING STRENGTH *',7(5X,A4,A3,' *'))
      WRITE(3,64)(IWRD(69,K),K=1,J)
   64 FORMAT('       BUOYANCY MATERIAL *',7(8X,A4,' *'))
      WRITE(3,65)(IWRD(70,K),K=1,J)
   65 FORMAT('0      CARRIER FREQUENCY *',7(8X,A4,' *'))
      WRITE(3,66)(IWRD(71,K),K=1,J)
   66 FORMAT('     DIRECTION REFERENCE *',7(8X,A4,' *'))
C
C END OF FIRST COMPONENT REC, TEST FOR SECOND REC,END OF TAPE
C
      IF(KPAGE)204,204,212
  204 IF(KEND-9999)206,200,206
  206 IF(J-7)208,210,210
  208 GO TO 202
  210 GO TO 201
C
C WRITE SECOND REC, 7 CHAR. ON TOP HALF & 42 ON BOTTOM HALF
C
  212 WRITE(3,67)((LWRD(I,K),I=1,2),K=1,J)
   67 FORMAT('            DISPLACEMENT *',7(5X,A3,A4,' *'))
      WRITE(3,68)(LWRD(3,K),K=1,J)
   68 FORMAT('   ELECTRICAL INTEGRITY *',7(8X,A4,' *'))
      WRITE(3,69)((LWRD(I,K),I=4,5),K=1,J)
   69 FORMAT('               FREQUENCY *',7(6X,A4,A2,' *'))
      WRITE(3,70)((LWRD(I,K),I=6,7),K=1,J)
   70 FORMAT('    LATERAL DISPLACEMENT *',7(7X,A1,A4,' *'))
```

```
      WRITE(3,71)(LWRD(8,K),K=1,J)
   71 FORMAT('                        MEDIUM *',7(9X,A3,' *'))
      WRITE(3,72)(LWRD(9,K),K=1,J)
   72 FORMAT('0  RESISTANCE CORROSION *',7(8X,A4,' *'))
      WRITE(3,73)(LWRD(10,K),K=1,J)
   73 FORMAT('  CORROSION PROT. BELOW *',7(9X,A3,' *'))
      WRITE(3,120)
  120 FORMAT(/,50X,'CONTINUED NEXT PAGE')
C
C END OF TOP HALF, WRITE 42 CHAR ON BOTTOM HALF FOR THIS COMP.
C
      WRITE(3,74)(COMP(I,NCP),I=1,8),NPAGE
   74 FORMAT(1H1,/,30X,'COMPONENT (CONT) = '8A4,26X,'PAGE 'I4,' (CONT)',
     1//)
      WRITE(3,32)(IWRD(3,K),K=1,J)
      WRITE(3,75)(LWRD(11,K),K=1,J)
   75 FORMAT('         STRETCH TO BREAK *',7(9X,A3,' *'))
      WRITE(3,76)((LWRD(I,K),I=12,13),K=1,J)
   76 FORMAT('              TIME CONSTANT *',7(4X,2A4,' *'))
      WRITE(3,77)((LWRD(I,K),I=14,15),K=1,J)
   77 FORMAT('                         SCOPE *',7(7X,A1,A4,' *'))
      WRITE(3,78)((LWRD(I,K),I=16,17),K=1,J)
   78 FORMAT('                     BUOYANCY *',7(5X,A4,A3,' *'))
      WRITE(3,79)(LWRD(18,K),K=1,J)
   79 FORMAT('0 CORROSION PROT. ABOVE *',7(9X,A3,' *'))
      WRITE(3,80)((LWRD(I,K),I=19,20),K=1,J)
   80 FORMAT('              POWER OUTPUT *',7(7X,A1,A4,' *'))
      WRITE(3,81)(LWRD(21,K),K=1,J)
   81 FORMAT('0          ANCHOR RELEASE *',7(9X,A3,' *'))
      WRITE(3,82)(LWRD(22,K),K=1,J)
   82 FORMAT('               ANCHOR TYPE *',7(8X,A4,' *'))
      WRITE(3,83)((LWRD(I,K),I=23,24),K=1,J)
   83 FORMAT('  ANCHOR WEIGHT, POUNDS *',7(7X,A1,A4,' *'))
      WRITE(3,84)((LWRD(I,K),I=25,26),K=1,J)
   84 FORMAT('   ANCHOR COST, DOLLARS *',7(7X,A1,A4,' *'))
      WRITE(3,85)(LWRD(27,K),K=1,J)
   85 FORMAT('              ANCHOR CHAIN *',7(8X,A4,' *'))
      WRITE(3,86)(LWRD(28,K),K=1,J)
   86 FORMAT('0                   ANTENNA *',7(9X,A3,' *'))
      WRITE(3,87)(LWRD(29,K),K=1,J)
   87 FORMAT('    AVERAGE TIME, SPEED *',7(8X,A4,' *'))
      WRITE(3,88)(LWRD(30,K),K=1,J)
   88 FORMAT('   AVG. TIME, DIRECTION *',7(8X,A4,' *'))
      WRITE(3,89)(LWRD(31,K),K=1,J)
   89 FORMAT('0       AUXILLARY FLOATS *',7(9X,A3,' *'))
      WRITE(3,90)((LWRD(I,K),I=32,33),K=1,J)
   90 FORMAT('        BALLAST MATERIAL *',7(7X,A4,A1,' *'))
      WRITE(3,91)((LWRD(I,K),I=34,35),K=1,J)
   91 FORMAT('             BALLAST WEIGHT *',7(5X,A4,A3,' *'))
      WRITE(3,92)(LWRD(36,K),K=1,J)
   92 FORMAT('0        MODULATION TYPE *',7(9X,A3,' *'))
      WRITE(3,93)((LWRD(I,K),I=37,38),K=1,J)
   93 FORMAT('                BAND WIDTH *',7(6X,A2,A4,' *'))
      WRITE(3,94)((LWRD(I,K),I=39,40),K=1,J)
   94 FORMAT('             CAPACITY A/H *',7(7X,A1,A4,' *'))
```

```
      WRITE(3,95)((LWRD(I,K),I=41,42),K=1,J)
   95 FORMAT('          CHARGING SYSTEM *',7(5X,A4,A3,' *'))
      WRITE(3,96)(LWRD(43,K),K=1,J)
   96 FORMAT('                  EFFICIENCY *',7(8X,A4,' *'))
      WRITE(3,97)((LWRD(I,K),I=44,45),K=1,J)
   97 FORMAT('                   DATA RATE *',7(4X,2A4,' *'))
      WRITE(3,98)(LWRD(46,K),K=1,J)
   98 FORMAT('0                      DRAFT *',7(8X,A4,' *'))
      WRITE(3,99)((LWRD(I,K),I=47,48),K=1,J)
   99 FORMAT('                        FUEL *',7(6X,A4,A2,' *'))
      WRITE(3,100)(LWRD(49,K),K=1,J)
  100 FORMAT('0INTERROGATION SECURITY *',7(8X,A4,' *'))
      WRITE(3,101)(LWRD(50,K),K=1,J)
  101 FORMAT('                 MAST HEIGHT *',7(9X,A3,' *'))
      WRITE(3,102)(LWRD(51,K),K=1,J)
  102 FORMAT('               MAST DIAMETER *',7(9X,A3,' *'))
      WRITE(3,103)(LWRD(52,K),K=1,J)
  103 FORMAT('   MOORING DEPTH CONTROL *',7(9X,A3,' *'))
      WRITE(3,104)(LWRD(53,K),K=1,J)
  104 FORMAT('0                 REDUNDANCY *',7(9X,A3,' *'))
      WRITE(3,105)(LWRD(54,K),K=1,J)
  105 FORMAT('                STORAGE CODE *',7(8X,A4,' *'))
      WRITE(3,106)((LWRD(I,K),I=55,56),K=1,J)
  106 FORMAT('                STORAGE TYPE *',7(4X,2A4,' *'))
      WRITE(3,107)((LWRD(I,K),I=57,58),K=1,J)
  107 FORMAT('0              REEL CAPACITY *',7(7X,A1,A4,' *'))
      WRITE(3,108)((LWRD(I,K),I=59,60),K=1,J)
  108 FORMAT('               SAMPLING RATE *',7(4X,2A4,' *'))
      WRITE(3,109)((LWRD(I,K),I=61,62),K=1,J)
  109 FORMAT('                   SCAN RATE *',7(4X,2A4,' *'))
      WRITE(3,110)(LWRD(63,K),K=1,J)
  110 FORMAT(' STATIC STABILITY ANGLE *',7(9X,A3,' *'))
      WRITE(3,111)(LWRD(64,K),K=1,J)
  111 FORMAT('                     SWIVELS *',7(9X,A3,' *'))
      WRITE(3,112)((LWRD(I,K),I=65,66),K=1,J)
  112 FORMAT('0TOTAL MOORING COST,  $ *',7(6X,A3,A3,' *'))
      WRITE(3,113)((LWRD(I,K),I=67,68),K=1,J)
  113 FORMAT('0      TRANSMIT INTERVAL *',7(7X,A1,A4,' *'))
      WRITE(3,114)((LWRD(I,K),I=69,70),K=1,J)
  114 FORMAT('       TRANSMIT DURATION *',7(7X,A1,A4,' *'))
      WRITE(3,115)((LWRD(I,K),I=71,73),K=1,J)
  115 FORMAT('0                     POWER *',7(2X,A2,2A4,' *'))
      WRITE(3,116)((LWRD(I,K),I=74,75),K=1,J)
  116 FORMAT('                    FUNCTION *',7(6X,A2,A4,' *'))
      GO TO 204
  970 REWIND 11
      CALL EXIT
      END
```

SCALARS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
J	0434	I	0438	MAXC	043C	KEND	0440	NPAGE	0444
KPAGE	0448	NCP	044C	K	0450				

ARRAYS

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
TITLE1	0454	TITLE2	04A4	COMP	04F4	IWRD	0BE4	LWRD	1098

CALLED SUBROUTINES

IJTARRF IJTAAFR IJTACOM IJTEXIT EXIT

LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION	LABEL	LOCATION
00010	0084	00001	00F0	00002	0138	00202	0164	00201	0176
00020	017E	00017	019E	00003	01F8	00014	02A2	00016	023E
00018	028E	00020	0206	00022	02F2	00024	02FE	00026	0336
00004	036C	00400	0404	00401	0418	00402	041E	00030	043C
00031	0450	00300	0456	00005	049C	00006	04D8	00007	0538
00032	059C	00033	0610	00034	0684	00035	0720	00036	078C
00037	0832	00038	08CC	00039	096C	00040	0AC8	00041	0884
00042	0844	00043	0BE4	00044	0C84	00045	0D20	00046	098C
00047	0F30	00048	0FA4	00049	0F40	00050	0FB8	00051	112C
00052	10A0	00053	113C	00054	11DC	00055	127C	00056	12F0
00057	138C	00058	1428	00059	14C4	00060	1564	00061	1636
00062	1678	00063	1714	00064	1788	00065	17FC	00066	1970
00204	18AA	00206	19BE	00208	1802	00210	18D8	00212	193E
00067	1954	00068	19C8	00069	1A64	00070	1B00	00071	1374
00072	1AE8	00073	1C5C	00120	1C9C	00074	1D14	00075	1D3C
00076	1F78	00077	1F14	00078	1FB0	00079	2024	00080	20C0
00081	2134	00082	21A8	00083	2244	00084	22F0	00085	2354
00086	23C8	00087	243C	00088	2480	00089	2524	00090	25C0
00091	255C	00092	26D0	00093	276C	00094	2808	00095	2934
00096	2918	00097	2984	00098	2A28	00099	2AC4	00100	2338
00101	2BAC	00102	2C2C	00103	2C94	00104	2D08	00105	2E7C
00106	2F18	00107	2EB4	00108	2F50	00109	2FEC	00110	336C
00111	3004	00112	3170	00113	320C	00114	32A8	00115	3344
00116	33F4	00900	341A						

COMPILATION COMPLETE AMOUNT OF COMMON 00000C AMOUNT OF CORE 019744 ADDRESS BASE TABLE 34C

APPENDIX Q

SOURCE CARD DECK FOR

THE BUOY COMPONENT DATA FILE RETRIEVAL PROGRAM

(Limited distribution of this Appendix is under separate cover)

DOCUMENT CONTROL DATA - R & D

UNITED STATES COAST GUARD

UNCLASSIFIED

COMPUTER PROGRAMS FOR NATIONAL DATA BUOY SYSTEMS SIMULATION & COST MODELS

DESCRIPTIVE NOTES (Type of report and inclusive dates)

FINAL REPORT

AUTHOR(S) (First name, middle initial, last name)

THE TRAVELERS RESEARCH CENTER, INC.

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	UNITED STATES COAST GUARD

13. ABSTRACT

This document is divided into three sections to logically present a different level for three sets of readers. Section 1, General Descriptions of Buoy Computer Programs and Data, provides a comprehensive summary of the computer programs and data developed. This section is primarily for a management overview and is intended to present computer program capabilities and data descriptions with a minimum of the related details. Included in Section 1 is a description of the:

(1) Integrated Buoy Deployment Cost Model Program
(2) Procurement, Maintenance, and Replacements-Cost Model Program
(3) 10-year TDP Financial Plan Program
(4) Buoy Component Characteristics Data File
(5) Fleet Numerical Weather Central Depth Data.

Section 2, Computer Programs Operating Instructions, is for those persons desiring another level of detail about the programs. This section presents the information necessary to prepare data card decks and operate the computer programs. It is assumed that the reader of this section is familiar with basic automatic data processing.

Section 3, is the Maintenance Programmer's Manula for the programs and data described. This section is for an experienced FORTRAN programmer and is supplemented with appropriate flow diagrams, compliation listings and tape dumps.

DD FORM 1 NOV 65 1473 (PAGE 1)

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